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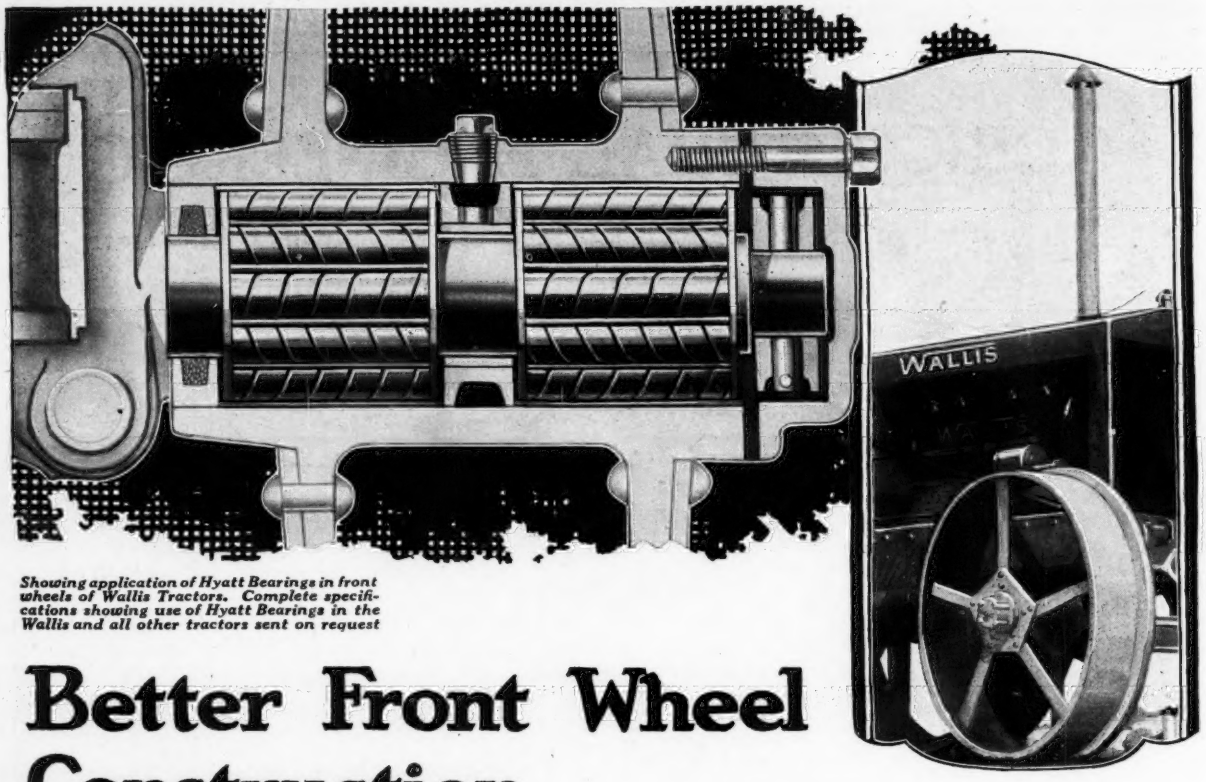

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Factors Influencing the Draft of Plows

By E. V. Collins

Mem. A. S. A. E. Assistant Chief, Agricultural Engineering Section, Iowa Agricultural Experiment Station, Ames, Iowa

AT THE LAST annual meeting of the Society, Prof. J. B. Davidson gave the results of a series of tests to determine the influence of speed upon the draft of a plow. The conclusions were that increasing the speed from two to four miles per hour increased the draft for the different conditions represented in the tests from 16 to 25 per cent.

This presents a disadvantage or at least an argument against high speed plowing. Other arguments are that greater damage will result to the plows if hidden obstructions are encountered and that is not what we might term "standard practice."

On the other hand, the lighter weight tractors cannot deliver their full drawbar power at a speed of two miles per hour, unless the footing is excellent.

These arguments are merely mentioned because of their influence upon our lines of research.

The tests reported by Prof. Davidson at the last meeting were all made with general-purpose bottoms, so naturally the next step was to compare the draft of various types of bottoms as influenced by speed. It appeared reasonable that a bottom approaching the breaker type when pulled at, say, four miles per hour, might do the same quality of work, and with no greater draft than a general-purpose bottom when pulled at two miles per hour.

OBJECTIVES:

1. To compare the draft of various types of plow bottoms as affected by speed.

2. To determine the power required to cut the furrow slice as compared to the power required for turning and pulverization.

Along with these two main objectives, tests were made to determine the effect of varying the depth of plowing and the effect of dull shares. The equipment used was an Oliver No. 11 sulky plow with stubble, general-purpose, breaker, slat and No. 222 bottoms, and a Vulcan tractor plow with stubble, general-purpose and speed bottoms.

The slice cutter used in these tests is a device built to cut the furrow slice loose without moving it. A heavy blade is bent to a right angle and supported on a wooden frame so as to cut 14 inches wide and up to 8 inches deep. A rolling coulter was used in connection with the vertical part of blade. Small wheels were attached to the side on the land to regulate depth. (See Fig.1)

The rear trucks of the Moline-Universal tractor were used and a low platform attached. This made it possible for one man to operate both the tractor and dynamometer with ease. The right rear truck wheel hugs the furrow wall, making it possible to keep the width of furrow uniform.

The Iowa dynamometer was attached directly to the drawbar of tractor.

METHODS OF TESTING:

One bottom only was used in all tests because it made the change of bottom simpler and also made it possible to secure higher speeds. The width of cut in all cases was 14 inches, and the length of tests 50 feet. All tests to be compared were taken at the same starting place and represented parallel furrows. The starting places were selected with a view to uniformity of conditions. The speed was determined by means of a stop watch.

Tests were eliminated for the following reasons: Excessive variation in depth, failure to get the time, and the failure to scour. These account for the missing points on the accompanying graphs.

FIELDS USED:

Field A was sweet clover sod. It was a clay loam and in

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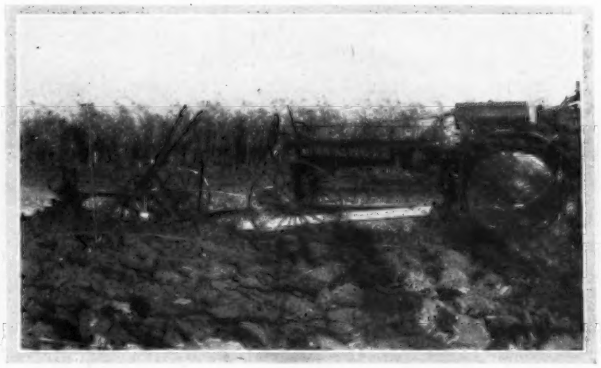
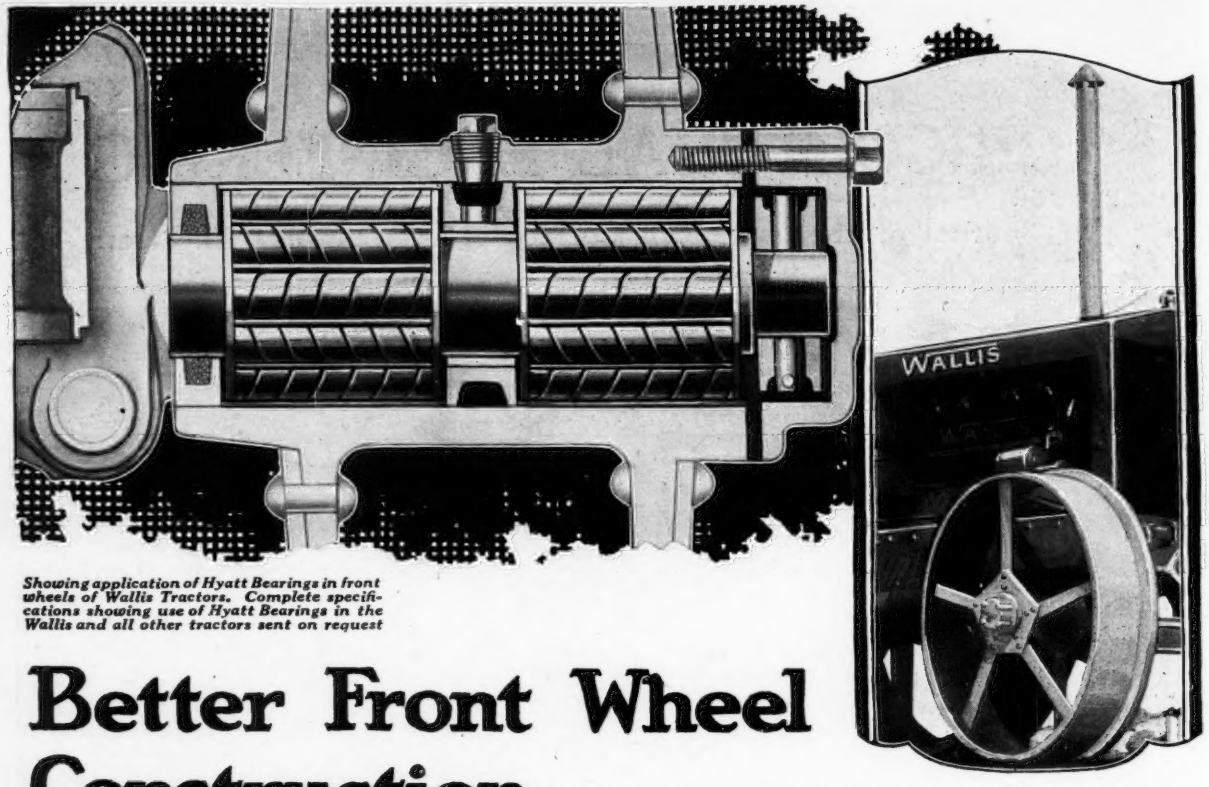


Fig. 1. (left) The slice cutter in use. Fig. 2 (right) The tractor fitted low platform under rear truck



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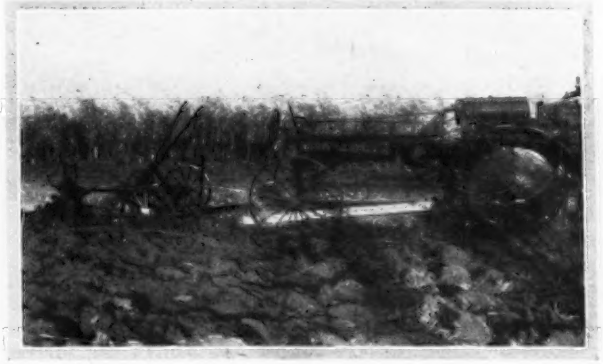

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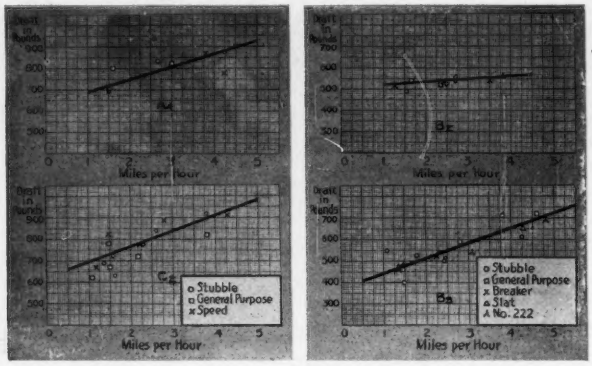

Fig. 3 (left) influence of speed on draft of three Vulcan bottoms; Fig. 4, (right) same for five Oliver plows, tests at four stations

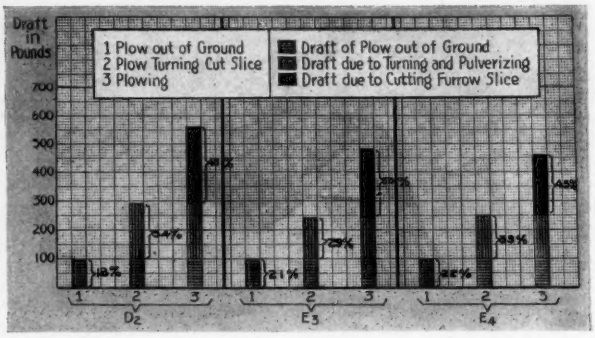

Fig. 5. Distribution of draft into plow chassis loss, cutting, and turning and pulverizing in different fields and with different bottoms

good plowing condition as regards moisture. It was plowed August 14. Four starting points were used.

Field B was red clover sod. It was a sandy loam, and was too dry to do good plowing, and turned up quite lumpy. It was plowed September 21. Three starting points were used. At station No. 2 the ground was especially dry.

Field C was wheat stubble. It was a Carrington loam and one end of the plot was in good condition as regards moisture, while the other end was too wet. There was considerable difficulty in scouring in the wet portions. This plot was plowed October 6, 8, and 9. Three starting points were used.

Field D was Sudan grass stubble. It was a sandy loam and was in good condition as regards moisture. It was plowed between October 22 and November 5. Only one starting point was used.

Field E was blue grass sod, unpastured. It was a sandy silt loam and was in good plowing condition as regards moisture. It was plowed November 10 and 22.

In the tests to determine the draft of various types of plows as affected by speed, each of the three bottoms for the Vulcan plow were tested at various speeds in Fields A and C. The depth in each of these tests was as near 8 inches as could be secured. As would be expected, this varied somewhat with different bottoms and it was found necessary to make corrections in the data to compensate for these variations in depth. The results are shown graphically in Fig. 3, Graph A4 representing the fourth station in Field A and C2 representing the second station in Field C.

Each of the five bottoms for the Oliver plow were tested at various speeds in Field B. A depth of 7 inches was maintained as near as possible. The results are shown graphically in Fig. 4. Graph B2 is of interest because of the small increase due to speed. It is my opinion that this is due to the fact that the furrow turned up in lumps and there was no pulverizing action after the soil was first broken loose.

Attempts were made to compare the general-purpose and breaker bottoms in Fields C and D. In Field E (blue grass sod) the slight advantage noted was in favor of the general-purpose bottom.

In the tests to determine the power required to cut the furrow slice as compared to the power required for turning and pulverization the slice cutter was used in Field C but we were unsuccessful in getting the plow to scour when turning the cut slice. It was noted, however, that *the draft of the slice cutter did not increase with the speed.*

In Field D the slice cutter was used again and no difficulty was experienced in getting the general-purpose bottom to scour when turning the cut slice. The aim was to make the plow run just a trifle shallower than the slice cutter, so that it would not drag on the bottom or cut more soil. The slice cutter pulled slightly harder than the plow itself so this could not be taken as the true measure of the power required for cutting. Also the shape of the blade is different from that of the plow. To arrive at the draft required for cutting the furrow slice, the draft required to turn the cut slice was subtracted from the draft required to plow. In the same way the draft of the plow out of the ground was subtracted from the draft required to turn the cut slice in order to determine the draft required for turning and pulverizing. These tests were made at speeds of about 2½ miles per hour.

The results were as follows:

Draft of plow of ground.....18 per cent
Draft due to turning cut slice.....34 per cent
Draft due to cutting slice.....48 per cent

The slice cutter was also used in Field E in connection with both the general-purpose and breaker bottoms with the following results:

Bottoms	Draft of plow out of ground	Draft due to turning	Draft due to cutting
General Purpose	22%	33%	45%
Breaker	21%	29%	50%

Fig. 8. A sample of the plowing done at six miles an hour in the course of the draft tests

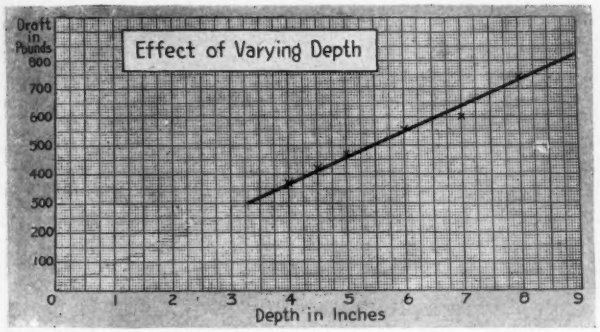

Fig. 6. Tests showing relation of depth to draft used to correct for small variations in depth

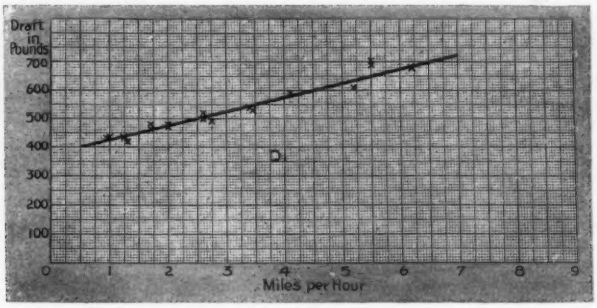

Fig. 7. Test of Oliver general-purpose bottoms in Field D. Shown because of close grouping of points

As would be expected the breaker bottom required a smaller per cent for turning, while the general-purpose required less for cutting. The breaker having a greater angle to the share throws more pressure against the landside and rear wheel and also supports a longer section of furrow slice. These results are shown graphically in Fig. 5.

A test to determine the effect of varying depth was made in Field D. Tests were made at 4, 4½, 5, 6, 7, and 8 inches. The results would indicate a uniform increase for these depths. In this case, the increase was about 92 pounds per inch of depth. The results are shown graphically in Fig. 6. This test was used as a basis for corrections to compensate for variations in depth as previously mentioned.

In tests to determine the effect of dull shares, a share was dulled by grinding the edge until it was ⅛ inch thick. Another was touched up with a file to make it as sharp as practical. Both shares were in good "form" except for the edge on the dull share. When tested in Field D (sandy loam) the difference in draft was almost negligible. In Field E (blue grass sod) a maximum of 14 per cent advantage was noted in favor of the sharp share.

Our observations on scouring might be termed "by-products" of the tests.

I believe the current opinion is that plows scour better at high speeds, at least that was my opinion. There was a spot in Field C about five rods long on one side where extreme difficulty was encountered in getting the plows to scour. High speeds were tried with no better results.

In one end of Field D, there was a narrow strip of corn stubble, and it was noticed that the plow would not scour through this at speeds about four miles per hour, while at lower speeds there was no difficulty. This was tried repeatedly to make sure of this point.

Fig. 7 has no direct bearing on the foregoing tests. This run was made with the Oliver general-purpose bottom in Field D. It was to be compared with another run made with the breaker bottom. Being unsuccessful in getting the breaker to scour the curve is shown because the points come nearer to a straight line than any which came to the observer's attention. The depth was exceptionally uniform.

CONCLUSIONS

1. The type of bottom does not materially influence the draft.

2. An increase in speed will produce about the same increase in draft with any type of bottom.

3. The increase in draft due to speed is confined to that part of the total which is required for turning and pulverizing. This varies with the speed from less than one-third to about one-half the total draft of plow within a speed range of two to four miles per hour.

4. Variation in depth is probably the greatest source of error in plow tests of a comparative nature.

5. Under some conditions of plowing, a sharp cutting edge is of little importance.

6. Under certain conditions high speeds may cause failure to scour.

Land Clearing with Dynamite

By **Arthur L. Kline**
Agricultural Service, Hercules Powder Company, Wilmington, Delaware

THE present time, when there is an apparent overproduction of agricultural commodities, may not seem to be one at which a subject may be most properly discussed which deals with the ways of bringing yet more land under cultivation and thereby increasing the total production of those same commodities. But we all realize that the total production of foodstuffs in the world is much below normal, and that it is only temporarily unbalanced economic conditions which prevent the farmers of the United States from contributing freely to the world's food supply, and thereby continuing to receive a fair share of the prosperity which has been theirs for the past five years; and which should always be theirs. And all those who look forward for more than the next ten years also realize that the natural increase in the population of the United States, especially the growth of the cities, makes it necessary for the government, both state and national, to decide upon and promulgate such methods as will always, or as long as possible, provide adequate acreage of tillable land to supply the nation's food. I say as long as possible, for our present national trend toward manufacturing and industrial life, with the natural and inevitable increase of population, will probably bring us in time to the place where we can no longer grow our own foodstuffs. However, that time is in the very dim future, and will be put off the

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longer as we are the more active and resourceful in bringing the largest possible percentage of our national area under the cultivation of more and better trained farmers.

So much concerning the interest of land clearing to this convention. It is indeed a very broad subject, but I wish to state in a few words just where dynamite is important in it. In one general sense, otherwise fertile, tillable land is rendered unfit for cultivation by excess water, stones, and plant growth, such as trees, brush, and stumps. Dynamite is used largely, in various parts of the country, to remove these encumbrances. In the rich bottoms of the Mississippi and its tributaries, hundreds of tons are used annually in blasting out ditches to drain off the water, and more to blow out the stumps from the land so drained. In various sections throughout the entire country there are areas in which rocks and stones are so thick as to interfere seriously with profitable farming. Here again dynamite is of value, though to a smaller extent than in ditching and drainage.

DYNAMITE USED CHIEFLY FOR REMOVING STUMPS

But by far the largest and at present most important of the uses of dynamite in land clearing, and the one which I suspect the committee who arranged this program had in mind when they assigned this subject, was its use in the removal of the third of the encumbrances I mentioned, that is, trees and stumps, and especially stumps. Figures from the United States Department of Agriculture in 1918 show approximately one hundred million acres of cut-over land in the southern states, thirty million in the lake states, and eight million in the Northwest, and there will doubtless be much more as more timber is removed. The figures for the lake states are probably somewhat reduced by this time, as lumbering is on the decline there, and of course much of this land will never be suitable for anything but more timber, or for grazing, but there are still millions of fertile acres which must eventually be cleared and produce foodstuffs.

It is in this field that dynamite at present finds its greatest agricultural usefulness. It does not, of course, do the whole thing, nor can it be used without a great deal of hard work. An area of cut-over land which is chosen to be cleared is first cleaned of brush, any second growth valuable for timber is cut and the brush and slashings burned. Then, especially if most of the stumps be hardwood, the field is pastured for a few years, preferably with sheep or goats, in order that the shoots may be kept down. If this is done, most hardwood stumps decay fairly rapidly, especially the smaller fibrous roots, and then the stump comes out cleaner and with less dynamite. Pine stumps decay very slowly, so they can be removed with the others or at any convenient time when conditions are right.

It is commonly accepted, in this last stage of clearing cut-over land, namely, the removal of stumps, that dynamite is almost essential. It is not, of course, the only way they can be removed. You can, as many of the early settlers did, grub out your stumps by hand, and many people use stump pullers without the aid of dynamite, but, as said before and as shown by recent investigations by state and national authorities, as well as the popular verdict, dynamite will either do the work itself or be of material assistance in doing a better job and reducing costs when tractor or stump puller are used.

The Wisconsin Experiment Station classifies the use of dynamite in stumping as follows:

1. To blast them out entirely

2. To crack them before removing either by use of a team, by using block and line with team, or pulling with tractor or stump puller

3. To split them after they have been pulled whole in order to make handling easier.

It will hardly be worth while to discuss at great length the technique of handling dynamite, but I believe that you can readily appreciate that in handling any substance of the nature of dynamite or blasting caps, there would be one, and also, that it would be varied somewhat to produce any one of the results enumerated before. But the basis is of course the same, and the same precautions in regard to the proper handling of the dynamite apply.

After deciding which method you are going to use in removing the stumps, after having carefully considered the kind and the condition of those stumps, then the kind and condition of the soil will largely influence the choice of the dynamite to be used. Dynamite, of course, is made in several grades or kinds and many strengths in each grade, and much depends upon the selection of the proper grade and strength. The kind most largely used for stumping is the ammonium nitrate grade made on a low-freezing formula, and in strengths varying according to conditions from 20 to 60 per cent. In all cases blasting should be done when the soil is wet, and the water in the pores of the soil tends to confine the gases generated by the detonation, rendering the explosive more efficient; and the roots slip out through the wet soil easier. The results are a saving in dynamite and a cleaner job, as there is less earth clinging to the roots, and the hole left in the ground is smaller. The low freezing quality of the dynamite most frequently used makes thawing unnecessary except in cold weather, as it does not freeze until after water freezes. Ordinary dynamites become insensitive at about 40 to 45 degrees Fahrenheit, and their use in this condition, as well as when as when they are frozen, is very inefficient.

MANUFACTURERS SUPPLY INSTRUCTIVE LITERATURE

The literature published by the manufacturers of explosives, as well as the bulletins put out by the national and various state agricultural experiment stations, is voluminous and readily accessible to everyone who is at all interested in the agricultural uses of dynamite and in land clearing. A few general remarks will give you an idea of the different conditions in which we find stumps that are to be removed, and the rules which in most cases apply. (But even the most experienced blaster will make a few trial shots before loading the charges under many stumps in a field he is not familiar with). In a heavy, wet, clay soil with hardwood stumps that are not well rotted and with pine, a 20 per cent ammonia dynamite will do good work. If properly placed well down beneath the center of load, a charge consisting of the right amount should heave stump and roots out of the ground, splitting the crown into several pieces, without much noise or scattering, and without leaving a large hole or packing of the soil. On a lighter soil, say a loam, possibly a 30 per cent dynamite of the same grade would do the best work, and on a really light soil a 40 per cent. Or if there were not much water present, even a 50 per cent might be necessary in a very sandy soil. The more decayed a stump is, the less resistance it would offer naturally to the force of the explosion, so the lower percentages, or slower dynamites, as we say, with the more heaving effect should be used in these cases. A general rule regarding the amount of explosive to use states that the number of pounds should be the same as the square of the diameter of the stump in feet. Thus a three-foot stump would require nine pounds of dynamite to blow it out. One-third to one-half less is necessary when the stump is only to be split. But, of course, this rule is subject to interpretation and modification according to any number of factors and local conditions.

A few words concerning the means of detonating the charge of dynamite after it has been properly loaded and

This pine stump was 157 years old and the diameters at the cut were three and four feet

thoroughly tamped. There is no question that, if a stump can be satisfactorily removed or split up by one charge located under the center and detonated by fuse and an ordinary blasting cap, that method is the most economical. Electric blasting caps cost about three times as much as ordinary caps and fuse.

But they are much safer and more convenient to handle, and there is no possibility of a delayed explosion, which is the source of most of the accidents in stump blasting. The down stroke of the plunger on the blasting machine generates an electric current and detonates all charges or none; if none, you can disconnect the lead wire from the machine and safely go back over your circuit to find out what may be wrong. Aside from the safety factor, the other important advantage is that it permits the simultaneous firing of several charges under the same stump. This is especially advantageous under very large lateral or semi-taprooted stumps, where one charge under the middle would only split the stump and leave the roots still very firmly fixed. Or if enough explosive could be put far enough below the center to blast out stump and roots, or even loosen them, the crater would be altogether too large. And it is also of value in removing large roots of a stump which has been burned to the ground. In this case there is almost no resistance at the center, and separate charges under each root could not be detonated simultaneously by fuse and cap, so that the combined effect would be dissipated in a number of separate explosions. But all could be connected and detonated at the same instant by electric caps and firing, and better results obtained with less dynamite.

It is quite impossible to give, on this occasion, accurate figures of general application concerning the cost of clearing land. It will be valuable, however, for everyone who contemplate using dynamite for any purpose to know that its price per hundred pounds decreases when bought in larger quantities. This price, when bought in lots of ten tons, a minimum carload, or more, is $3.25 less than the ton-lot price, and $5.75 less per hundred pounds than the less-than-ton price. And the same thing is true of caps, fuse, and electric caps. It is also true, in land clearing as in other things, that the larger the scale on which an operation is conducted, the lower its cost, if efficiently managed. So far there has been little of this large-scale work done in land-clearing, though there has, of course, in what is known more strictly as reclamation work. The reason is, I suppose, that land clearing could struggle along as the individual settler's own proposition, while the reclamation had to be done by the Government on a large scale, or not at all. But the farmers are beginning, in this as in other things, to get together and cooperate, especially in their buying.

It will not be long before there are more than the present few individual operators who will undertake land clearing operations on a large scale. Some will go into it as contractors, as the few at present in the field will hardly be able to supply the demand for their services which will soon come about. More will take over large acreages and clear them for their own farming, and doubtless secure large and deserved profits. Of course, labor has been expensive and hard to get, but that condition ought soon to improve. And there are power boring machines, improved devices for piling stumps, and other means which render the work of gangs trained in the art of land clearing very efficient indeed. Improvements are constantly being made in machinery for pulling stumps after they have been split and loosened with dynamite, and quite recently an entirely new idea in the way of stump pullers has been completed.

All of the manufacturers of explosives are aware of the service they can render American agriculture by spreading information concerning the more efficient use of explosives in farming as well as land clearing, and are prepared, through their advertising service departments, and cooperation with all agricultural agencies to do a great deal to put these ideas into practice. The company I am associated with would appreciate any opportunity which might be offered by the members of the American Society of Agricultural Engineers to cooperate with them along this line.

Preservative Treatment of Wood in Farm Structures

By E. C. Mandenberg

Mem. A. S. A. E. Technical Representative, Barrett Company, Chicago.

THAT the practice of wood preservation on our farms is the most immediate step towards timber conservation is not to be questioned. Forty-six per cent of the lumber used annually in the United States finds its way into farm buildings. Consequently, it is of the utmost importance that the designers of farm structures not only control the factor of durability in design and specifications, but realize their own responsibility for the proper utilization of timber and its conservation.

The subject of farm structures has been treated in different papers read before this body and in articles which have appeared in AGRICULTURAL ENGINEERING. In the previous discussions the location, plans, specifications, and bills of material have been discussed thoroughly but the matter or proper utilization of species and of prolonging the period of service of the material used in construction of farm structures has not been given the thought it rightfully deserves.

It is a well-known fact, perhaps not generally understood by all users of wood in its various forms, that the different kinds of woods vary greatly as to their lasting qualities, and this is particularly true when timber is placed in situations where conditions are favorable for decay to set in and progress. Such commercial woods as heart cypress, the cedars, chestnut, redwood,white oak, fatty or close-grained dense pine resist decay naturally, but it is not always possible to obtain these woods in rural communities and where they are available the price the farmer has to pay is prohibitive. Such species as are available to the farmers usually contain more or less sapwood, have wide annual growth rings, and are not durable timbers.

The sapwood of all species of timber is readily broken down by fungi (wood destroying organisms) when exposed to the weather or where in contact with the ground, concrete, metal, or timber. This natural tendency of woods used in structural work to decay can be retarded for considerable periods if the timbers are properly creosoted and this can usually be accomplished at a relatively small additional increase in the initial cost. In fact the species of wood which decay most rapidly are most easily cresoted by methods available to every user of timber.

It is not for me to discuss the different types of structures which are built on the farms of the country. Our state agricultural colleges are fast solving this problem. When a farmer wishes to build a new farm building he goes to his county agricultural agent and tells him what he wants, how many head of stock of the different breeds he wishes to accommodate, or what other use he wishes to make of the buildings, etc. The county agent in turn communicates with the agricultural engineering department at the state agricultural college or the agricultural extension specialist and the blue prints, bills of material, and specifications are sent out.

All too frequently the construction details and bills of material call for timber, species and grade, which are not readily available to the average farmer.

For example, the bills of material frequently specify No. 1 white pine for hog house floors when any cheaper grade of timber of any available species could be used with economy, if properly creosoted, and the cost of cresoting the less durable woods plus labor is often less than the difference in cost between the durable species which are not readily available and the less durable grades which are easily obtained. The ordinarily fast rotting species of wood properly creosoted will give a longer period of service and a lower annual maintenance cost than the more durable kinds.

Paper presented at the fourteenth annual meeting of the American Society of Agricultural Engineers held at Chicago, December 28 to 30, 1920.

The forms of timbers used in farm buildings and to which nonpressure treatments with refined coal-tar creosote can be economically and advantageously applied are shown in the accompanying outline.

Refined coal-tar creosote can also be used to stain the outside of all buildings and the deep rich brown color which it imparts blends well with farm surroundings.

The farm woodlots usually contain species of timber which are ideal for any rough building timbers which the farmer is called upon to use. In most localities portable mills operate and the logs cut on the farm woodlot can be sawed to any bill. Prof. R. S. Hosmer, head of the forestry department at Cornell University, recently said, "A woodlot properly managed is a bank that never refuses the farmer's draft. Every farm has constant need for wood, and a woodlot is not only an asset to the property, but, when wisely used, helps to conserve the Nation's timber supply.

"A good share of the material needed for construction, for repairs to vehicles and implements, and for fencing as well as for fuel, can be obtained from the woodlot. This saves money that would otherwise be paid for high-priced lumber.

"Treatment with preservatives will lengthen the life of wood and also permit the use for construction purposes of many species which otherwise could be used only for fuel."

PROPER MANAGEMENT MAKES WOODLOT PAY

This use of timbers grown on the farm woodlot not only cuts down the cost of the farm structures very materially but aids the great conservation movement which is sweeping over the country. Unless our timber resources are conserved and put to the best use, posterity will be without timber. All too frequently the farm woodlot does not pay because of improper management. Valuable large logs are cut up into fuel wood, when systematic thinnings could be made and the first two or three cuts of each tree sawed into timber and the tops used for fuel. Such thinnings would remove the mature trees and improve the quality of lumber to be sawed later from the trees left standing, by giving them a better chance to grow and develop straight boles.

The specifications for farm structures should be so drawn, and the blue prints made to show, that all timbers placed on the ground or in contact with masonry as well as all stringers, joists and braces are creosoted at points of contact. Hog and chicken house floors should be creosoted to make structures more sanitary and to control the insects and pests which are found in great numbers in these structures. In this connection U. S. D. A. Farmers' Bulletin, No. 801, entitled "Mites and Lice," states that "both lice and mites are found in practically every locality where poultry is raised. Where present in any considerable numbers both lice and mites reduce egg production and hinder growth and reduce the qual-

ity of flesh of all classes of poultry. Refined creosote oils are recommended for control."

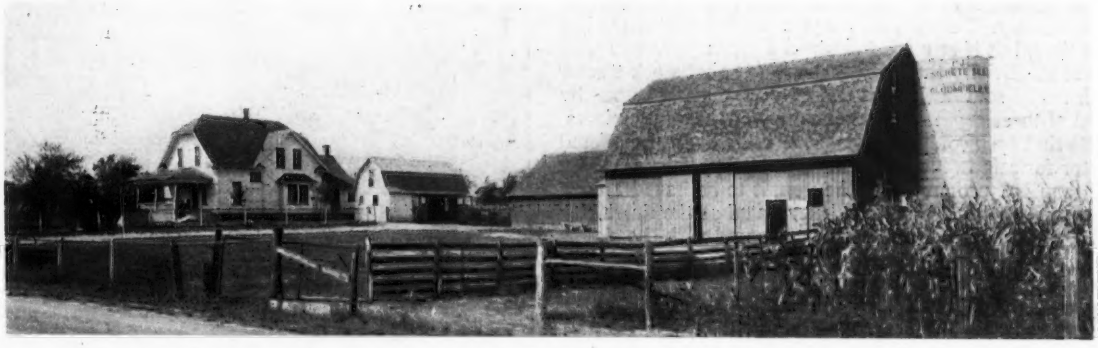
White ants or termits cause serious damage to timbers and this can be prevented. Farmers' Bulletin No. 1037, "White Ants," states that poles, posts, construction timbers, and other wood in contact with the ground should be treated with preservatives to render the wood more resistant to attack by termites. Of the more superficial methods of preserving timber, brush or dipping treatments with coal-tar creosotes have proved most effective."

All timbers used in farm structures can be creosoted by the open-tank process which has been described in previous papers read before this Society. This requires a small outlay for equipment. In lieu of the open-tank method, the surface treatment can be applied. Two brush or spray coats are recommended and the refined creosote should be heated to not to exceed 175 degrees Fahrenheit. All materials should be air-dried and completely framed before creosoting.

The word "creosote" covers a multitude of sins and the consumer going to a dealer and asking for creosote oil may

Forms of Timber Used in Farm Buildings

1. Farm House
   - (a) Sills
   - (b) Stringers (points of contact)
   - (c) Studs (" " ")
   - (d) Foundation posts
   - (e) Basement planking
   - (f) Porch columns, stair stringers, and flooring
   - (g) Shingles
2. Barns
   - (a) Foundation posts
   - (b) Sills
   - (c) Stall floors
   - (d) Feed alleys
   - (e) Feeding troughs
   - (f) Studs (points of contact)
   - (g) Joists (contact with masonry)
   - (h) Shingles
3. Implement Sheds
   - (a) Sills
   - (b) Posts (points of contact)
   - (c) Shingles
4. Sheep Sheds
   - (a) Posts
   - (b) Gates
   - (c) Fence boards
5. Poultry Houses and runs
   - (a) Roosts
   - (b) Floors
   - (c) Entire inside
   - (d) Posts
   - (e) Base boards
6. Hog Houses
   - (a) Floors
   - (b) Skids
   - (c) Shingles (where used)
   - (d) Entire structure inside and out for sanitation and to save painting
7. Hog Pens
   - (a) Posts
   - (b) Gates
   - (c) Fence boards
   - (d) Feeders
8. Animal Shelters
   - (a) Posts
   - (b) Gates
   - (c) Fence boards
9. Corrals
   - (a) Posts
   - (b) Gates
   - (c) Boards
10. Silos
    - (a) Staves
    - (b) Doors
    - (c) Chute
11. Granaries and Corn Cribs
    - (a) Floors
    - (b) Joists
    - (c) Posts
    - (d) Studs (points of contact)
12. Well House
    - (a) Curbings
    - (b) Floor
    - (c) Studs (points of contact)
13. Fencing
    - (a) Posts
    - (b) Gates
    - (c) Braces
14. Bridges and Culverts
    - (a) Stringers
    - (b) Floors
    - (c) Railings and posts.



actually get a product which has little or no preservative value. The engineers and designers should accept a standard refined creosote oil specification and have the state agricultural colleges analyze the various wood preservatives which are offered for sale to the farmers of any state and then recommend only those which, in addition to being chemically effective, are physically fit. Then some educational work must be carried on to educate the users of timber by timely talks in widely circulated periodicals.

The engineers on the agricultural extension forces can assist materially in this educational work by publishing bulletins on the preservative treatment of farm timbers, by illustrated slide lectures, and by writing "copy" for the bulletins circulated monthly by the county agents of their state.

The writer has been cooperating with specialists on the staffs of the agricultural colleges and it has been repeatedly suggested that projects be drawn up along the lines of a community creosoting tank. In other lines such community projects have been worked out successfully. The writer is interested in such a project and would appreciate suggestions and ways and means of cooperating where such a project is workable.

The following statistical data in connection with the subject of wood preservation is of interest:

1. Original forest area of the United States is 822 million acres.
2. Original stand 5200 billion board feet.
3. Over two-thirds culled, cut over, or burned.
4. Left today—
   - 137 million acres virgin timber
   - 112 million acres culled or second growth timber
   - 133 million acres partially stocked
   - 81 million acres practically waste land

We have 463 million acres today of all sorts and stand amounts and about 2214 billion board feet of merchantable timber. In other words, three-fifths of the original timber is gone.

5. Cutting and loss annually equals 56 billion board feet, of which 40 billion is cut from virgin stands and 16 billion from second growth.
6. All told we are taking 26 billion cubic feet from our forests and growing only 6 billion cubic feet.
7. In thirteen Central States, the valuation of farm buildings in 1900 was $1,700,000,000, in 1910 was $3,300,000,000 and in 1920 was $12,200,000,000. In the same thirteen states where there are 3,375,000 farms, 13 per cent, or 300,000, expect to build new houses; 24 per cent, or 550,000, expect to build new barns; 10 per cent, or 245,000, expect to build new hog houses; 5 per cent, or 110,932, expect to build new corn cribs; 4 per cent, or 90,000, expect to build new granaries; 7 per cent, or 166,000, expect to build new machine sheds, and 23 per cent, or 545,000, expect to build new miscellaneous structures. These figures were compiled by "Successful Farming" in 1920.

Tractor Testing in Nebraska

By **Prof. Oscar W. Sjogren**

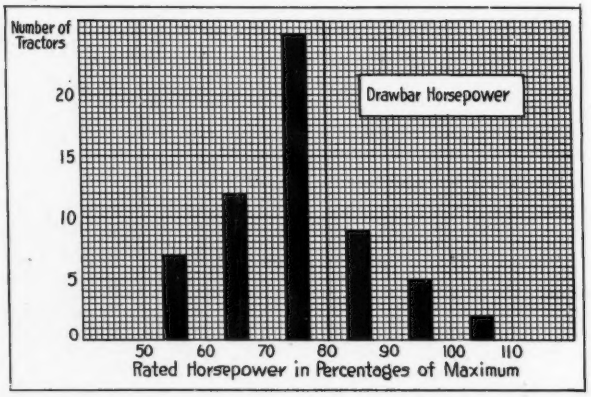
Mem. A. S. A. E. Head of the Department of Agricultural Engineering, University of Nebraska, Lincoln, Nebraska

IN PREPARING the outline for this paper I pondered whether or not to go very extensively into the history of the events leading up to the passage of the tractor testing law in the 1919 session of the Nebraska Legislature. I decided that you would be more interested in the results obtained than in the history of the law, therefore I shall not touch upon the passage of the law except very briefly and shall take up in more detail the carrying out of the work under the provisions of the law and the results obtained to date.

The Nebraska Legislature was composed to a considerable extent of farmer members some of whom had purchased tractors that would not stand up or give them more than a few hours' service. The bill was introduced by such a man in the lower house and was followed through the senate by a farmer member who was a large tractor user. To my knowledge there was no effort to block the passage of the law in either house and it is my recollection that it passed practically unanimously. I shall not give you the full text of the law at this time, but if any are interested I can supply you with copies of it. Briefly the provisions are (1) that stock tractor of each model sold in the state be tested and passed upon by a board of three engineers in the employ of the state university; (2) that each company, dealer, or individual who offered a tractor for sale in Nebraska must have a permit issued by the state railway commission, the permit to be issued after a stock model of that tractor has been tested at the university and the performance of the tractor compared with the claims made for it by the manufacturer; (3) that a service station with a full supply of replacement parts for any model of tractor shall be maintained within the confines of the state and within reasonable shipping distance of customers; (4) and that enforcing of the provisions of this law shall be placed in the hands of the state railway commission.

Paper presented at the fourteenth annual meeting of the American Society of Agricultural Engineers held at Chicago, December 28 to 30, 1920.

No provision was made in the law for financing of the work and as a consequence the funds of the University were drawn upon for the expenses connected with the work which were not at all meagre. Farmers of our state consider this money to be well expended as is indicated by letters and remarks which we have from our people over the state that the reports of the test which they have received or requested have saved them considerable money, in some instances $200 or $300 per farmer. Considering that we have 15,000 tractors in the state and in the next few years fully that many tractors will be sold, it can very well be imagined that an enormous sum will be saved to Nebraska tractor users alone by



Drawbar rating practice as shown by Nebraska tests

the operation of the law and issuing of the reports. The reports, however, are not limited to the farmers of Nebraska but are available to farmers of the entire country, and I might say the entire world. Requests have been received from several foreign countries for the reports. As we were anxious to know whether or not the reports were in such form as to be interpreted by the farmers of the state, we sent out a questionnaire to those who had received the reports and every letter that has come back without exception states that the reports have been very valuable and have given splendid information.

The organization for carrying out the work consists of three members of the department of agricultural engineering, at the University, as a board of tractor test engineers, the members being chosen from that department because of the fact that it has the supervision of the tractor work of the institution and it was thought that the members of that department were most familiar with the tractor situation. A manager of tractor tests was engaged to take active charge of the work and to carry out the details of it. For this position Prof. C. K. Shedd who is well known to most of you was secured and through him is due in no small way the successful carrying out of the work, as he organized the whole and brought it into successful operation.

A GREAT DEAL OF WORK NECESSARY TO GET STARTED

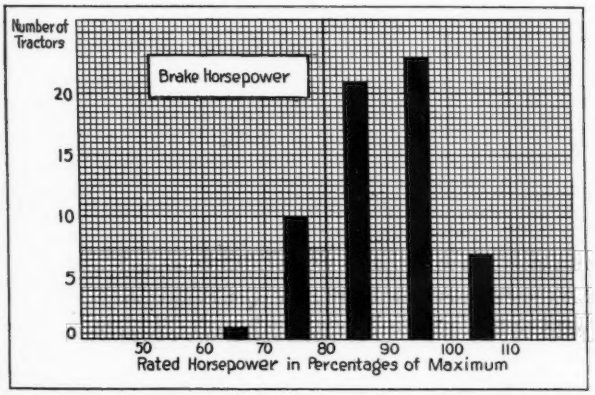
A large number of meetings were held and rules adopted for carrying out details of the test. Equipment had to be designed and built. The provision as stated in Section 3 of the Nebraska tractor law that the official tests of the University must be compared by representations of the tractor company as to horsepower rating for not less than ten consecutive hours continuous load, fuel used for developing such horsepower, and any other representation such company shall make, presented a problem not heretofore encountered in my tractor testing work. The thought of securing enough land to plow with the tractors which would appear was considered as impossible for several reasons, some being the impossibility of testing tractors under anywhere near approximate uniform conditions of soil and climate through any extended period of time, the impossibility of securing the amount of land necessary, and the large force of men and equipment which would be necessary to carry out this work at such times as land would be available. It was therefore decided to carry out the drawbar testing work on a cinder track using a specially designed dynamometer car for measuring the pull and recording the same for the drawbar horsepower computations. The cinder track was adopted because it was thought that it would be nearer to stubble field conditions under which the tractors operate mostly in our state. It has also thought that cinders would allow of rapid drainage and drying off after a rain, enabling us to get on to the track in the shortest possible time. It was found that this assumption on our part held fairly true, though at times the condition of the track was not what we wished it to be.

The equipment necessary for carrying out the belt tests made it necessary to secure some building where the same could be housed and where testing could be carried out during inclement weather. There was no building upon the campus suited for such a purpose and it was therefore decided to build a special building to house the belt dynamometer and appliances such as fuel and tools, and offices of the tractor testing force. This building as constructed is 41 feet in width, and 82 feet in length with a 14-foot ceiling. Some mention of the arrangement of this building may not be out of place. The outside walls of the testing shed in which the tractors are housed during the test contain approximately 2340 square feet of wall space. Of this area 294 square feet consists of windows and 232 square feet of door space. This makes a total of 526 square feet of window and door openings, or more than 22 per cent of the wall space, besides this two ventilators in which exhaust fans are installed, are placed in the ceiling above this tractor shed. A Sprague electric dynamometer is housed in a separate room at one end of the shed.

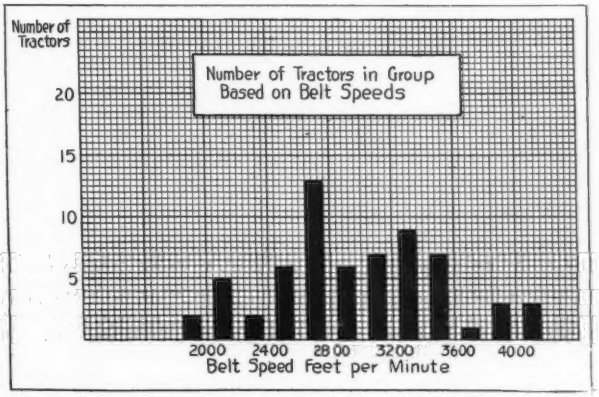
The Sprague dynamometer was decided upon as most suitable for the belt tests rather than a Prony brake as it was thought that an electric dynamometer would stand up and be more satisfactory under the continued heavy usage to which it would be subjected. Scales were obtained for the weighing of the fuel and a scale stand constructed which would permit the placing of the fuel tank on the scales at the same height as the fuel tank of the tractor insuring the proper pressure upon the carburetor.

SPEED COUNTERS DO GOOD WORK IN TRACTOR TESTS

Speed counters were secured and rebuilt. A brief description of the speed counter used may not be out of place here as it gave us splendid results and enabled us to get very accurate readings of speed at both ends of the belt, that is, at both the dynamometer and tractor ends at exactly the same instant so that the belt slippage could be closely checked. Electrical connections are so arranged that when the speed counter is applied to the engine shaft and placed in operation electric contact is made throwing in the clutch of the speed counter at the dynamometer and so that the two operate simultaneously. When the counter at the engine is withdrawn the contact is broken and the clutch released. This eliminates personal error, and the speed can be accurately checked. This was used for the inside testing work. Engine speed was checked on the outside testing work by the use of tachometers, and the rate of travel of the tractor was checked by timing it between stations set definite distances apart.



Belt power rating practice as brought out in tests



Range and distribution in belt speed of tractors

Securing equipment for the outside drawbar testing work presented a very serious problem which we finally solved by the designing and equipping of a specially built dynamometer car or loading machine. This was constructed of a tractor chassis, from which the engine had been taken and in its place an electric dynamometer or generator installed. The power was transmitted from the drivewheels to this generator when the machine was pulled by the tractor. By means of control rheostats the amount of current delivered from the generator could be very easily controlled. The recording unit of a Gulley traction dynamometer was installed in this car and the dynamometer or pressure unit was hitched between the tractor and this car. In this way a record was obtained of the pull exerted by the tractor in pulling the load. This machine would furnish a drawbar pull upward of 5000 pounds, and if it was necessary to obtain a greater pull, loads of various description were attached back of the dynamometer car. Such loads usually consisted of rollers, drags, old tractors and graders. The tractors on the track were kept under test continuously for ten hours on the rated drawbar load, and the maximum pull being of short stretches occupied about one hour's time. At the end of the season this testing car had seen very heavy duty, having done more than 1,000 hours running which is more than a tractor would receive in a season on the average farm. In lieu of this hard usage the car stood up remarkably well and we feel that even though it is not in as high state of perfection as we desire that it has served its purpose admirably well and it has given us an excellent solution to a difficult problem. The track was kept in condition by means of graders, rollers, drags, and sprinkling at intervals as required.

SCHEDULE OF TESTING ADOPTED BY TESTING BOARD

The outline of tests and the order thereof as adopted by the tractor testing board is as follows: (a) Drawbar work from one-third to full load for 12 hours, this test being for the purpose of limbering up; (b) brake horsepower at rated load and rated speed for two hours, the purpose of this test being to show whether or not the tractor will carry its rated load on the belt, also to show fuel consumption at rated load; (c) brake horsepower test at load varying from maximum to no load with all engine adjustments as in test (b) for one hour, the object being to show fuel consumption and speed control on varying loads; (d) brake horsepower test at maximum load for one hour, with governor set to give full opening of fuel valve and carburetor adjusted to give maximum power the object being to show maximum horsepower and behavior of the tractor on the belt and its fuel consumption; (e) brake horsepower test at one-half load for one hour with governor set as in test (b) and carburetor adjusted for most economical operation at one-half load, to show fuel consumption at one-half load; (f) drawbar horsepower test at rated load for ten hours, this test being made on a half-mile cinder track to show whether or not a tractor will carry its rated drawbar load continuously and also to show fuel consumption on drawbar work; (g) maximum drawbar horsepower test, which consisted of a series of short runs with an increase of load for each run until the engine is overloaded or the drivewheels slip excessively; (h) miscellaneous, which may include investigation of work on inclines, turning radius, effectiveness of brakes, or any other feature of the tractor which may require special observation, and (i) tractor is under observation for endurance throughout the complete test as above outlined.

The tractor manufacturer was requested to furnish an ample number of operators for his tractors while being tested. The manufacturer's operator was in charge of the tractor during the limbering up run. This was permitted in order to be sure that the tractor was properly worked in and also to give the university operator an opportunity to become familiar with the machine so that he could properly take it over during the test following the limbering up run. The manufacturer was requested to keep his operator present during the entire test, but he could not make any adjustments or changes except first having permission from the engineer in charge. This order of procedure was carried out throughout the test and was found to work very satisfactorily.

One hundred and three applications for testing tractors were received for the season. Of these sixty-eight appeared for test and thirty-five had their applications cancelled and temporary permits withdrawn. Of the sixty-eight which appeared for test thirty-nine went through without any changes while twenty-nine made changes as follows: four changed their rating, seven failed to make their rating, six changed the rated engine speed, eleven changed some item of equipment, and three withdrew after being on the preliminary test. Of the eleven which changed equipment, two also changed their rating. One of those which withdrew later made a reapplication and appeared and finished the test. These results in themselves I believe speak very loudly for the necessity of a method of testing and rating of tractors as has been carried out under the provisions of this law. These tractors have all been tested under conditions as nearly uniform as it is possible to obtain them by a competent force of men who have been unbiased and unprejudiced.

It may be interesting to compare the performance of the large number of tractors tested and note how nearly they conformed to the recommended standards of the American Society of Agricultural Engineers and the Society of Automotive Engineers. The standards as to horsepower ratings read as follows: "The drawbar rating shall be 80 per cent of the horsepower that the tractor is guaranteed to develop at the drawbar continuously for two hours, the tractor being in good condition and properly operated at rated engine speed. The test should be taken on ground particularly firm to give the tractor a good footing, a firm sod being preferable." "The belt horsepower rating shall be 80 per cent of the horsepower the engine is guaranteed to deliver at the belt pulling continuously for two hours the tractor being in good condition and properly operated at rated engine speed." In this discussion we have the record of sixty-five models and sizes of tractors. The figures from the results show some interesting revelations. The results of the maximum belt horsepower tests are used as 100 per cent and the manufacturers rating is shown in percentages of the maximum power developed continuously for one hour, and shows how nearly this conforms to the 80 per cent standards.

RATED BELT HORSEPOWER IN PERCENTAGES OF MAXIMUM

	60-70%	70.1-80%	80.1-90%	90.1-100%	Above 100%
Number of Tractors.	1	10	21	23	7

Three tractors were not rated. Thus it is seen that only eleven machines fall within the set standard, while fifty-one machines carry a rating higher than permitted by the standard.

On the drawbar work it was found that except in two instances no difficulty was had in securing the rated drawbar horsepower if the rated belt horsepower was developed. The maximum drawbar horsepower was not through any extended period but the rated load was carried for ten hours. The same method of figuring is used here as in the case of belted horsepower.

RATED DRAWBAR HORSEPOWER IN PERCENTAGES OF MAXIMUM

	50-60%	60.1-70%	70.1-80%	80.1-90%	90.1-100%	Above 100%
Number of tractors.	7	12	25	9	5	2

(Five tractors had no drawbar rating)

Thus it is seen that forty-five tractors fall within the standards set for the drawbar rating as compared to only seven falling in this class on the belt tests. Seventeen carry a rating higher than the standard, two of these being rated at more than they can actually develop.

Much has been said about rating tractors based on vol-

metric displacement and the following figures have been compiled from the results and are all based on the maximum belt horsepower maintained at rated speed for one hour. Of the sixty-five tractors the lowest piston displacement is 9420 cubic inches while the highest is 18,720, the next to the highest being 16,730. The weighted average for all tractors tested is 12, 376 cubic inches. The tractors were divided into classes based on types and numbers of cylinders with the following results:

2 cylinder	horizontal	(10 tractors)	10,950 cu. in.
4	"	"	(10 ")	11,520 " "
4	"	vertical	(42 ")	12,950 " "
6	"	"	(2 ")	13,868 " "
1	"	"	(1 ")	18,720 " "

A classification as to bore of cylinder gives the following:

Bore of cylinder in inches		
3 to 4	13 tractors	13,400 cu. in. displacement
4⅛ to 5	28 tractors	13,240 cu. in. displacement
5⅛ to 6	9 tractors	11,440 cu. in. displacement
6⅛ to 7	8 tractors	11,630 cu. in. displacement
above 7	7 tractors	11,390 cu. in. displacement

BELT SPEED

A very great variation exists in the belt speeds, in feet per minute, of the different tractors as indicated by the following:

Less than 2000 ft.	2 tractors
2000-2199	5 "
2200-2399	2 "
2400-2599	6 "
2600-2799	13 "
2800-2999	6 "
3000-3199	7 "
3200-3399	9 "
3400-3599	7 "
3600-3799	1 "
3800-3999	3 "
Above 4000	3 "

The figures obtained in the test permit analyzing the problem in still greater detail from different angles but I believe that those presented herewith are sufficient to indicate that the work has at least brought out some data upon which no comparative figures have been available and I will leave it to you to determine whether or not this work which has been done at a great expenditure of time, money and effort, is really worth while.

Mental Tests for Predicting Success in Agricultural Engineering

By Dr. H. E. Burtt and Prof. F. W. Ives

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Mem. A.S.A.E. Head of the Department of Agricultural Engineering, Ohio State University

TWO YEARS AGO the Ohio State University inaugurated the psychological test with a view to determining before the mid-semester examinations if possible the mental capacity of all entering students. It was thought that by giving the so-called "nut test" to students for a period of say three years, and in the meantime comparing the results of the mental tests with the actual performance of the student in the class room, that it would be possible to give entrance examinations of this sort and eliminate the probable failures at the beginning rather than at the end of their first semester. The advantage of such a test is at once apparent as, if successful, it would relieve now overcrowded class rooms and laboratories of much "dead timber."

The college of engineering instituted at the same time tests for indicating possible professional tendencies, with the thought in mind that after a few years of the tests, with careful comparisons of class work and so far as obtainable success in the profession after graduation, it would be possible to predict success or failure in some degree before the student had wasted several years of more or less fruitless study.

After a consultation between the head of the department of psychology and the dean of the college of agriculture arrangements were made by the authors of this paper to conduct similar and more searching tests on the senior students majoring in agricultural engineering, as a research in the possibility of developing more exact methods for predicting success in agricultural engineering. Such methods when finally perfected will be valuable in vocational advice and selection of students in the department of agricultural engineering. Thus it is hoped that it will be possible for the sophomore advisors to guide a student into a line of work that he seems most fitted for without the guessing that is the rule now. It is important in such work to proceed empirically, comparing efficiency in various tests with efficiency in vocation. It seemed probable that seniors in the college of agriculture could be estimated with reference to their ability fairly accurately. Accordingly mental tests were given to about fifty seniors in June 1920 and the estimated success compared with tests scores. Further tests were given to forty seniors in December 1920. These latter were all majoring in agricultural engineering.

Three instructors in the department of agricultural engineering rated these students for probable success in this vocation. The ratings were made on a linear scale (Table 1). One of the instructors rated all fifty men for probable success in agricultural engineering, although many of these men were not specifically enrolled in that course. The other two instructors rated only the men who were specializing in this field.

The ratings were recorded in millimeters. In order to make these different ratings comparable, it was necessary to transform them into a standard form. One instructor might rate all his men high and another might rate all his men low, and in comparing the two it would be the relative standing that would be of importance. Accordingly the ratings made by each instructor were averaged and the standard deviation obtained. Then that instructor's ratings were transformed into terms of standard deviation so that the final rating meant that the instructor graded his men for example two-tenths of the standard deviation above the average. These heterogeneous ratings could then be averaged into a single score for each student.

Twelve tests were given in all by means of mimeographed blanks. The procedure occupied about one and one-half hours. It is difficult to say what any mental test measures, but there were in the twelve used four in which the empha-

Paper presented at the fourteenth annual meeting of The American Society of Agricultural Engineers held at Chicago, December 28 to 30, 1920.

sis was upon the processes of attention, one of learning, one of association, one of memory, two of reasoning, one of ingenuity, and two of the ability to follow directions. Examples of the five tests which were ultimately retained are given in Table II.

Each test in the group was roughly correlated with the vocational score to see whether the person who scored well in that test was rated high in the vocation and vise versa. On the basis of this preliminary correlation, seven tests were discarded as being insensitive to this vocational variable and five were retained. With these five correlations were computed by a more accurate method ("partial moments") which involved the products of deviations of the measures from their average. The tests were also intercorrelated and the technique of partial correlations employed ("See Yule's "Statistics"). It was then possible to weigh each test in proportion to its correlation with the vocation and its independence of tests. A regression equation was then derived. This is a linear equation in which each test score is multiplied by a constant. This equation gives the best possible weighting of the various tests from the standpoint of predicting vocational success with this group of data. The equation was then transformed slightly so that the original test scores could be put into it directly.

The regression equation obtained was V=.004 (.0311)+ .019 (0321)+.039 (0541)+.015 (1302)—.023 (1403)— 1.878, where figures in brackets refer to scores in the five tests. Five original test scores for each man were then weighted according to this equation to obtain a single score. These final scores are given in Table III together with the average vocational score as well. These final weighted scores are the ones which would be used with people of unknown ability in order to predict probable success in agricultural engineering. The vocational scores are arranged with the men rated highest at the top of the column. The corresponding combined test scores, it will be seen, tend to distribute similarly with the large positive values toward the top of the column. The correspondence is not perfect but by no means random.

If the correlation between these columns is computed by the usual methods this degree of correlation corresponds theoretically to the distribution given in Table IV. For illustration let the successive rows represent ability in combined test score and successive columns represent vocational ability. The table then reads as follows: Suppose 1000 people took the tests and we selected first the 100 with the highest score (i. e. the highest tenth of the group) then the 100 next in rank (i. e. the second tenth), etc. Suppose we likewise divided them into ten groups on the basis of vocational ability—a highest tenth, a second tenth etc. Then of the 100 people who were highest in test score, 32 would be in the highest tenth in vocational, 19 is the second highest vocational tenth, etc. Of that 100 who were next to the highest test group, 19 would be in the highest vocational 10th, 16 in the next highest, etc.

Instead of predicting what per cent of people would fall within certain vocational limits, the table may be used equally well to predict the *probability* of an individual success. For example, if an individual gets a test score which is in the highest tenth of a standard set of such scores, the chances are 32/100 that he will be in the next highest 10th, etc. Thus, if a student's test score is known the table

TABLE I

Showing Method of Making Ratings on a Linear Scale

Please rate all of the following persons, with whom you are familiar, as to probable success in this vocation. Imagine all the persons engaged in this work whom you have ever known divided into five groups of equal size, a highest fifth, a next highest fifth, a middle or average fifth, etc. Place a cross in the proper column after each person's name to indicate in which fifth he will be found AFTER HAVING HAD SUFFICIENT EXPERIENCE TO READ HIS MAXIMUM EFFICIENCY. If he stands high in a given fifth, place the cross toward the right side of the column and vice versa. In other words the greater the vocational ability the farther to the right of the page the cross should be placed. If in the case of any individual his success is apt to be determined by other factors beside ability, e. g., personality, laziness, etc., please take a special note of this fact.

	Lowest fifth	Next Lowest fifth	Middle fifth	Next Highest	Highest fifth
Jones, John	.....	.....	.....	.....	.....
Brown, Frank	.....	.....	.....	.....	.....
Albery, John	.....	.....	.....	.....	.....
Smith, Clyde	.....	.....	.....	.....	.....
Mortgan, Sam	.....	.....	.....	.....	.....
Stone, Thomas	.....	.....	.....	.....	.....
Miles, James	.....	.....	.....	.....	.....
Wells, Frank	.....	.....	.....	.....	.....
Evan, Lyle	.....	.....	.....	.....	.....
Myers, George	.....	.....	.....	.....	.....

TABLE II

Five Mental Rating Tests

0311

26	52	39	24	53	37	16
						f
14	33	18	47	12	21	56
d				b		
49	44	59	29	55	31	42
35	20	11	50	15	46	27
		a		e		
58	41	28	38	57	34	48
30	23	54	45	19	13	40
					c	
17	32	47	25	51	43	22
9						

0321

atchdeerfeg hhiajvkel mbneoepng rmsatnuyv
there have been many
waxtytzeambpctdse ftgoh idjekvlimsneo
attempts to devise

0541

2. Write the missing number: 6% of $240 is the same as 4½% of.... (320)
3. 60 pounds of camping outfit are carried. A B and C share the load in these proportions: 2 parts to A, 1 part to B and 1 part to C. How many pounds does each carry? A 30 lbs B15 lbs C15 lbs

1302

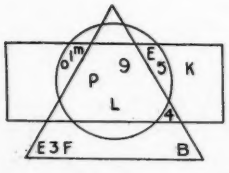
emosu mouse

eeggor George

cehrry cherry

1403

1. Vowel that is in triangle but not in circle or rectangle. (E)
2. Smallest number in circle and rectangle but not in triangle. (5)



makes it possible to predict his chances for success in agricultural engineering as indicated.

For convenience it might be desirable to condense the table in some manner as the following: Let the best three tenths in vocation be arbitrarily called "good," the next three tenths "average," the next three-tenths "poor," and lowest tenth "very poor." Then of 100 scoring in the tests:

1st tenth—65 will be good, 24 average, 10 poor, 1 very poor, in vocation, 2nd tenth—49 will be good, 32 average, 17 poor, 2 very poor, in vocation, 10th tenth—6 will be good, 19 average, 43 poor, 32 very poor.

Thus if the lowest 10th in test scores were refused admission to this course of study, there would be 6 per cent good agricultural engineers ruled out but along with them 32 per cent very poor ones and 43 per cent poor ones. The result of drawing the lines at any arbitrary point can be easily determined.

TABLE III

Final Scores From Mental Rating Tests

Name	Vocational Score	Combined Test Score
D.S.W.	149	511
J.C.N.	132	665
W.E.S.	112	456
J.F.D.	108	247
L.M.F.	103	-007
G.W.K.	946	841
E.A.S.	89	075
W.L.D.	83	-156
H.J.R.	76	941
J.L.H.	76	-232
C.H.C.	72	533
H.C.B.	60	110
A.W.B.	48	476
C.A.H.	47	294
G.B.A.	44	-312
B.O.	28	-172
W.M.M.	04	483
A.D.S.	0	642
W.S.M.	0	449
R.J.S.	-04	-601
G.A.D.	-04	-118
C.E.G.	-04	-380
T.C.K.	-04	084
C.W.S.	-04	-356
G.M.B.	-12	536
J.C.D.	-17	017
E.D.L.	-32	086
E.J.W.	-36	-056
W.R.G.	-39	378
R.O.R.	-32	263
R.E.H.	-60	-740
S.R.S.	-64	347
P.R.L.	-84	297
R.L.S.	-112	-734
K.L.E.	-112	265
H.A.R.	-116	-481
B.M.D.	-117	-236
L.A.K.	-120	-175
T.G.A.	-121	156
H.F.L.	-132	013
V.G.B.	-188	-262
S.G.	-192	-550

The above study should be considered only preliminary. It is based on only forty-two cases and with many of these only one vocational rating was available. The regression equation was worked out to predict this variable that was rated and is consequently dependent on the reliability of the rating.

The correlation obtained in the present instance is higher than that generally found between academic variables and intelligence. The supposition is that agricultural engineering requires special aptitudes as well as intelligence. The correlation is not as high as that sometimes found in the industrial field. It will be possible to increase it by devising other tests to include in the equation. The effect of this would be to increase the values in the upper left portion of Table IV and decrease those in the upper right.

It is suggested that the present seniors in agriculture be given these five tests which were retained in the first equation as well as some others which it is desirable to try out, that those men be rated and correlations worked out as before in order to improve the reliability of the regression equation and, if possible, to increase the magnitude of the first correlation.

Standardization

EVERY farmer is interested in the subject of standardization as it refers to farm machinery. If standardization means anything it means conservation and economy, and standardization in the design, materials, and parts of a machine when scientifically carried out not only tends to increase the efficiency and improve the performance of the machine, but it also tends to improve the service which the farmer receives from manufacturer or dealer. In fact, standardization and the elimination of superfluous sizes and styles of machines is something that should receive the hearty support of every farmer, because in the end it means not only more efficient equipment but cheaper equipment as well.

However, one of the serious obstacles to the progress of standardization at the present time is the overcoming of certain prejudices that have grown up in different sections of the country for certain designs that are most popular in those sections. In many cases there is little if any reason for these prejudices except that the users have become accustomed to certain styles or designs and it is not always easy for them to accept something which will in every way be just as satisfactory, and which possibly would be a step forward in the progress of standardization development. It is well, therefore, for farmers who desire to encourage the standardization movement to be willing where it seems desirable to sacrifice some of their whims and thereby assist in the general movement of standardization which has wonderful possibilities from an economic point of view.

An editorial reprinted from "Power Farming"

TABLE IV

Distribution of Arrays of Successive Tenths of a Group When r = .50

Tests Score		1st tenth	2nd tenth	3rd tenth	4th tenth	5th tenth	6th tenth	7th tenth	8th tenth	9th tenth	10th tenth
1st	tenth	32	19	14	10	8	6	5	3	2	1
2nd	"	19	16	14	12	11	9	7	6	4	2
3rd	"	14	14	13	12	11	10	9	8	6	3
4th	"	10	12	12	12	12	11	10	9	7	5
5th	"	8	11	11	12	11	11	11	10	9	6
6th	"	6	9	10	11	11	11	12	11	11	8
7th	"	5	7	9	10	11	12	12	12	12	10
8th	"	3	6	8	9	10	11	12	13	14	14
9th	"	2	4	6	7	9	11	12	14	16	19
10th	"	1	2	3	5	6	8	10	14	19	32

Standardization of Farm Wagons

By E. E. Parsonage

Assoc. A. S. A. E. Secretary and Manager, John Deere Wagon Works, Moline, Illinois

THE great bulk of farm wagons sold today are designated as Light, Medium, Standard and Heavy, in line with the recommendations I made in 1913 in a paper read before this Society. The rear axle is also branded with the intended carrying capacity as predicted in my paper of that date.

Prior to three years ago there were nine different sizes of two-horse wagons, and all wagons were rated according to the size of the skein. This rating meant nothing to the farmer and was delusive in the extreme because all skeins of different makes have different carrying capacities in a given measurement. That is, one 3¼-inch skein may not have over 60 per cent of the carrying capacity of another 3¼-inch skein, thus the farmers were deluded many times about the capacity of their wagons.

Again, before standardization was made effective, a wagon factory catering to the farmers trade in various territories, was required to build in the 3¼-inch size wagon *only*, forty-eight different kinds of gears and ninety-five different kinds of wheels.

This meant the necessity for building 912 distinct different kinds of 3¼-by-10 farm wagons, exclusive of brakes.

Under the old plan by multiplying the varieties in each different size of wagon demanded by the farmer it was possible to build, to meet all the individual whims and preferences, 4560 different kinds of farm wagons.

Under the present standardized schedule on the new wagon size, that is, one size of wagon branded "Standard," the following only are retained: four different kinds of wagon gears and twenty-one different kinds of wheels, which reduces the variety to five different kinds of wagons in this one size.

At the present time it is only necessary to build 224 different kinds of farm wagons under the standardized schedule.

The standardization of farm wagon equipment has only started. Is there any reason, or even good sense if you please, in furnishing the farmer with 224 different kinds of farm wagons, when the only variable factor encountered in transporting farm produce from the farm to the market is the size of the horses, the variation in the load to be carried, and in the condition of the road over which the load is hauled.

Wagon wheels have been culled to essentially two heights, 40-44-inch and 44-48-inch, both heights taking the same gear construction. Steel wheels for farm trucks have also been standardized to the extent that at the present time only two combinations are required, 28-32-inch and 30-34-inch. Five years ago the truck manufacturers carried something like twenty-five different heights of steel wheels.

One-horse wagons are made very largely today in only two sizes, light and heavy, designated as such, with steel or wood axles, and with only one wheel height, namely 40-44 inch.

The track or tread of wagons and farm trucks has been standardized for the past two years. The more progressive manufacturers have made nothing but the standard auto track (56 inches) since January 1, 1919. Prior to 1918 farm wagons were made in seven different tracks, ranging from 4 feet 6 inches to 5 feet 2 inches.

The standard track was initiated as a conservation measure during the war. This track was selected first because the automobile uses the 56-inch tread and it is commonly acknowledged that the automobile is the track maker. The standard track has been approved by the Secretary of Agriculture, the Department of Commerce, and numerous trade organizations. There are still some few ill-advised manufacturers who constitute the usual minority that invariably work against any economic change that has ever taken place.

ALL RAILROADS NOW HAVE STANDARD WIDTH TRACKS

Up to a few years ago the tracks of various railroads differed, and as an instance, when a carload of grain arrived in Erie, Pennsylvania, over one road and was transferred to another line or road, the car of grain had to be shoveled into another car, because the rolling stock of the forwarding line was of a different gauge.

Until very recently farm wagons were made in six different widths of track, and the farmer moving from one state to another, or from one locality to another, was forced in most cases to sell his entire transportation equipment at a sacrifice, because his wagons and trucks would not fit the track of the territory into which he was moving.

Prior to 1917 wagon tires were rolled in round edge and square edge stock. Now practically all wagons are made with a compromised tire called the oval edge. Better and more prompt service to the consumer results from this and other simplifications.

A practical example of what standardization has already done is noticeably and forcefully seen in the comparison I am going to give you of two orders, each for a carload of wagons from the same merchant in Tennessee. The first order is dated November 1, 1913, and the second order is dated July

Paper presented at the fourteenth annual meeting of the American Society of Agricultural Engineers held at Chicago, December 28 to 30, 1920.

Order No.1. (Carload of Farm Wagons)

_____ November 1, 1913
_____,Tenn. Order No._____
Via_____ For shipment at once

Amount	Size	Kind	Wheels	Tire	Remarks.
1	3½x11	1132	40-44	3x¾ R.E.	3x4 reach, 12' long
1	3¼x10	1130	40-44	3x¾ R.E.	8-inch stakes
3	3¼x10	1130	40-44	2x¾ R.E.	8-inch stakes
2	3¼x10	1130	40-44	2x¾ R.E.	10-inch stakes
3	3 x 9	1128	40-44	2x¾ R.E.	8-inch stakes
2	3 x 9	1128	40-44	1½x¾ R.E.	10-inch stakes
3	3 x 9	1128	40-44	2x¾ R.E.	10-inch stakes
3	3 x 9	1128	40-48	1½x¾ R.E.	10-inch stakes
2	2¾x 8½	1126	40-44	1½x⅝ R.E.	10-inch stakes
2	2¾x 8½	1126	44-52	1½x⅝ R.E.	12-inch stakes
2	2¾x 8½	1126	40-44	3x½ R.E.	10-inch stakes
1	3 x 9	1128	44-52	1½x⅝ R.E.	12-inch stakes
2	1¼x 7	418	40-48	1¼x5/16	
2	1¼x 7	418	40-48	2x⅜	

Order No. 2. (Carload of Farm Wagons)

_____ July 26, 1921,
_____,Tenn. Order No._____
Via_____ For shipment at once

Amount	Factory Number	Capacity in Pounds	Size	Height of Wheels	Size of Tire	Weight
7	No. 329-A	4500	Standard	40-44	3x⅝	1182
11	No. 327-A	3000	Medium South	40-44	3x½	1230
7	No. 323-A	1500	Light	40-44	2x½	935
5	No. 511-A	800	Light One-horse	40-44	2x⅜	485

The farm wagon, long standard in type, now is standardizied as to track and other important features

26, 1920. These orders furnish an excellent example of "before and after taking."

Notice that in the first order, the merchant specifies for thirty wagons of eighteen different varieties. The second order received from the same merchant in 1920 calls for thirty wagons and only four varieties.

Instead of the three months service on the first order the second order was shipped within ten days after receipt of order.

Now from the farmer's standpoint, when he purchased a wagon from this merchant in the case of the first order he probably got what the dealer had left to sell. In the case of the last thirty wagons the farmer bought a wagon specifying rated capacity. The wood stock, skeins and axles were made to stand up, under extreme conditions, with the load capacity branded on the rear axle.

TIRE WIDTH SHOULD ALSO BE STANDARDIZED

There are still made dozens of different tire widths and thicknesses. The farmer himself, in the past three years, has very largely eliminated the old popular narrow tires, that is, 1½-inch and 1¾-inch widths. However, in some cases there is still a demand for them, and a decided stand should be taken by all parties interested in standardization to eliminate at least the narrow tires that are detrimental to road surfaces.

Our first object then should be to recommend the tire schedule for farm wagons that will not only prevent the injury to the road surface, but aid in preserving it.

Your Society is cooperating with the wagon manufacturers, and I think it appreciates the fact that is so important to all manufacturers, that is, that no schedule of standardization or simplification can be successful unless it takes into full account the interests of the farmer, whose interest in the final analysis must be of first importance.

The manufacturer, distributor and merchant are vitally interested in further simplification of varieties, because it spells for all parties more prompt service, reduction of stocks, better articles for less money, and a vehicle that is suited to the actual load and road conditions versus the old method of catering to every individual's whims and ideas.

In order that we may arrive at still more concrete results, as a representative of the wagon industry I am going to ask your convention to O.K. by resolution and in spirt the following:

(Let me say first that the tire schedule submitted has been approved several times by the wagon manufacturers in convention, and differs only in one small instance from the scientific investigations of tire widths and road surfaces conducted by the bureau of public roads of the United States Department of Agriculture. This one variation comes under the standard wagon.)

"We recommend and sanction the following schedule of tire widths for farm wagons, thickness to be governed by topographical conditions:

	Maximum capacity	Tire width
One-horse wagon	1500 lbs.	Not less than 2", alternate 3"
Light two-horse wagon	2500 lbs.	Not less than 2", alternate 3"
Medium two-horse wagon	3000 lbs.	Not less than 3"
Standard two-horse wagon	4500 lbs.	Not less than 3", alternate 4"
Heavy two-horse wagon	6000 lbs.	Not less than 4", alternate 5"

"That the carrying capacity of all farm wagons and trucks should be plainly branded on the rear axle, to the end that the purchaser will clearly understand the carrying capacity as guaranteed by the manufacturer. That we approve and sanction as economically sound the single standard of track for all horse-drawn vehicles, that is, the automobile track, 56 inches, center to center of tire on the ground.

"That we voice approval of such further standardization and elimination of varieties as will tend to better service and more effective vehicle transportation based upon the continued improvements in road conditions."

Finally, gentlemen, you may be assured that the wagon manufacturer of today is willing and anxious to cooperate along sound economic lines, realizing that standardization in all lines of industry will result in greater production, increased quality and a reduction of the price to the consumer.

Higher Standard of Farm Life

IT IS generally recognized that the automobile has appreciably raised the standard of farm life and ideals; there is plenty of evidence that tractors, motor trucks, and other labor-saving equipment, as well as more comfortable, more convenient, and better lighted and heated farm homes are having the same influence. In fact, all these things which come within the scope of agricultural engineering makes possible the maintenance of the highest standard of rural life to be found anywhere in the world and should receive as much attention from the federal department of agriculture and the state agricultural colleges as do other branches of agriculture. All honor to the worker in pure agricultural science, but let none forget that his research and discovery seldom are of more than acedemic value until they are engineered to the farm.

Farm Building Ventilation

UNDER the heading of "recommendations" in its last annual report, the committee on farm building ventilation suggested that it was quite important for the committees on farm structures, farm building equipment, and ventilation to work together to produce farm buildings that might be designated as "climatic structures." We suggested that some plan should be devised by which the information secured by each committee can be available at once for consideration by all these committees.

No plan having been devised for this purpose, the committee on ventilation has continued its study of this problem, not knowing what the other committees have done in relation to it.

As a result of the study that the chairman of this committee has given to the subject of "Climatic Dairy Barns," the article on this subject published in the October number of AGRICULTURAL ENGINEERING is presented as a summary and we submit it as a part of this report.

You will recall that in the last annual report assurances were given that Dr. H. P. Armsby's interest had been enlisted in the work of this committee and through him we expected to reach definite conclusions regarding the heat production of farm animals. We are assured that the results of his findings are now in manuscript form and will soon be published. We have been in correspondence with Dr. Armsby during the past year, and while we are not at liberty to quote him directly, there are certain points that have been brought out in this correspondence which will give hints as to the great value of his manuscript as it relates to farm building ventilation.

The heat production of animals is exceedingly variable, depending upon the size of the animals and their degree of activity and to a very large extent upon the amount and kind of feed consumed by them. There are two quite distinct sources of heat production in the animal body. The first of them is the heat arising from the necessary activities of the animal. On page 711 of Dr. Armsby's book entitled, "The Nutrition of Farm Animals," Tables I and II show under the heading of net energy and expressed in therms (one therm equals 1,000 kilogram calories) the amount of heat thus produced by cattle, sheep, horses, and swine of different weights. On page 625 of the same book (Table 195) there is shown in the last column the amount of heat production caused by the consumption of 100 pounds of dry matter of different feeding stuffs. On page 656 (Table 198) are shown quite similar figures for swine.

OBTAINING AMOUNT OF HEAT PRODUCTION OF ANIMALS

To obtain the amount of heat production of animals, it is necessary to add 50.9 therms per hundred pounds of dry matter consumed, to the heat arising from the necessary vital activities of the animal in a state of rest, as shown in Tables I and II above referred to. Dr. Armsby's results will show the heat production of the various sizes and kinds of animals when they are being fed several different rations. Prof. F. H. King states that a cow may eliminate 76,133 B. t. u. per day.

This amount of heat given off by a cow per day would be about the same as if 7.4 pounds of coal were burned in a stove at 75 per cent efficiency. In a barn where 30 cows are housed the heat given off would be equivalent to burning about 225 pounds of coal per day. When 30 head of cattle are housed in a barn for 10 days continuously, the amount of heat given off compares with the heat from a ton of coal burned in the same space.

This comparison is interesting in that it shows, first, the absolute necessity of reducing to a minimum the heat losses through the walls of a barn in a cold climate, if it is expected that the temperature of that barn is to be controlled without the use of artificial heat. Second, it seems entirely feasible to arrange the floor plan and superstructure of the ordinary barn so that it will not be necessary to use any artificial heat added to the waste heat given off by the cows, in order to control the temperature of the room. Furthermore, agricultural engineers will be interested to know that Dr. Armsby clearly demonstrates the necessity for trained agricultural engineers as specialists to solve these problems properly.

Rapid progress is being made in the task of connecting up the producton of heat by animals with the use and waste of this heat for ventilation and by loss through the walls, respectively. In a test of the barn at the Brandon experimental farm Prof. L. J. Smith, then of the Manitoba Agricultural College, obtained a very good record of the conditions of ventilation, temperature and head production, which will be found in full on pages 79 to 80 inclusive of AGRICULTURAL ENGINEERING Volume 1, Number 4 (December 1920).

As a result of correspondence with Prof. J. P. Calderwood, head of the department of mechanical engineering of the Kansas State Agricultural College, we have secured his active interest in our work. A complete report of this correspondence is found on pages 78 and 79 of AGRICULTURAL ENGINEERING, Volume 1, Number 4 (December 1920).

ACCURATE AIR MOVEMENT DIFFICULT TO OBTAIN

To make observations of air movement which are accurate and thorough is one of the most difficult tasks in connection with the problem of analyzing the ventilation of farm buildings. Some valuable suggestions along this line have been received during the past year from two sources. In the report of the committee on research of the American Society of Heating and Ventilating Engineers we find the following under the heading of "BEST WAY TO TAKE ANEMOMETER READINGS" "1. The opening shall be divided into equal rectangular areas, no side of which shall be over ten inches long, excepting where this would require more than ten readings, in which case the opening shall be divided into twelve equal areas.

"2. Readings are to be taken in every case in the center of every area.

"3. Readings to be of one-half minute duration, the anemometer being held at the register base or in the plane of the opening.

"4. Where the diffusers are used a total area is to be computed on the basis of the periphery of the diffuser.

"5. The average of the readings are to be considered as the average velocity at the opening. Where negative velocities are found, they are to be deducted in arriving at the average velocity.

"6. In computing volume, the net area of opening is to be taken, the volume to be considered as the product of the average velocity and the net area of the opening.

"7. If the anemometer is held two inches from the register face, no deduction shall be made for the area occupied by the register face."

In answer to inquiries as to the measurement of the flow of air in the testing of ventilators and ventilating systems, the U. S. Bureau of Standards has submitted the following under

Report of committee on farm building ventilation presented at the fourteenth annual meeting of the American Society of Agricultural Engineers at Chicago, December 28 to 30, 1920.

the heading of "MEASUREMENTS OF SMALL PRESSURE DIFFERENCES:"

"The accuracy attainable depends on the magnitude and constancy of the head to be measured. If the pressure difference to be measured remained constant a vertical U-tube could be used, the head being read by means of a traveling microscope. In most cases the pressure difference varies considerably and it is necessary that the gauge be sensitive enough to show these variations so that we may take an average over a period of time. If the pressure difference is large enough, an inclined gauge may be used. When the pressure difference is small, no entirely successful method has been devised. The difficulty in the use of a gauge of small slope is to make the gauge so that the slope does not change in the course of time. When it is remembered that in the case of a Pitot tube placed in a ventilating pipe, the head will be of the order of 1/25 inches of water, that a slope of 25 to 1 is needed to give a 1 inch scale reading, and that therefore an error of 1/200 of an inch in the vertical height of the gauge means an error of ten per cent in the head, the difficulties are obvious. It is possible in a laboratory with expert handling to get results of value, but the manipulation is very troublesome.

VELOCITY DIFFERS IN PARTS OF VENTILATOR PIPE

Our advice would be to abandon the Pitot tube entirely. You realize that the velocity varies in the different parts of a ventilator pipe and that twenty or more readings would have to be taken in the different parts of the pipe to compute the average velocity. The wind velocity past the ventilator would have to be constant while these readings were being taken.

If the speeds in the ventilator pipe are not too low, it is possible to use an ordinary anemometer. The ventilator pipe must be horizontal so that the anemometer is vertical. The anemometer is moved slowly back and forth along a diameter for several minutes. Check readings are taken along other diameters. In this way it is possible in many cases to attain an accuracy of five per cent. If comparative readings only are desired, the anemometer may be fixed at the center of the pipe. This instrument cannot be used if the speeds are below 200 feet per minute and is not very accurate if the speeds are below 300 feet per minute.

Beginning early this year the chairman of this committee has been corresponding with the Secretary of the United States Department of Agriculture, emphasizing the importance of the ventilation of farm buildings and the need for research work on this subject.

In reply to our letters the Department wrote as follows: "Considerable work has been done by the Bureau of Public Roads of this Department in the way of ventilating systems in the various barns for which plans have been made, but no investigations have been made, the work having been based on data secured from other sources. The available information on this subject is very meagre.

"We realize the importance of the proposed investigation and believe that a cooperative arrangement could be made with the American Society of Agricultural Engineers to carry on this work. It is thought that this Department might detail a barn architect for about one-third of his time, his salary and traveling expenses to be paid by the Department, which would make it necessary for the American Society of Agricultural Engineers to secure the barns in which the investigations would be carried on, and to provide the equipment as might be necessary.

Carrying out these suggestions, M. A. R. Kelley of the division of agricultural engineering of the Bureau of Public Roads was appointed to spend four months of his time on this work. Mr. Kelley has also been appointed as a member of this committee so that we are able to cooperate close in this work.

Since this Society has no funds with which to carry on research work, the matter of securing equipment appeared to be a difficulty. However, a circular letter sent to the agricultural engineering departments of the various state agricultural colleges brought offers of the use of a large number of the necessary instruments. It was decided to begin the field work as early as possible in winter and with this end in view a trip was planned into northeastern North Dakota where winter conditions could first be met. Mr. Kelley has succeeded in securing instruments for his work, hence it has not been necessary so far to call upon any of the colleges for the loan of their instruments.

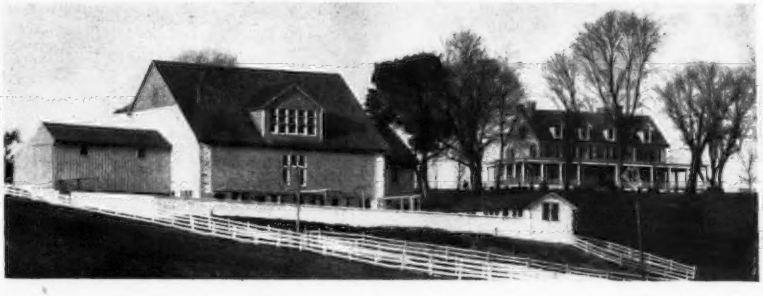
Mr. Kelley accompanied by W. B. Clarkson and C. S. Whitnah have been engaged in field work since December 1, 1920. They have spent the first half of this month in the vicinity of Grafton and Edinburg, North Dakota, where they have made tests in several combination dairy and horse barns. Some very interesting data has been secured which will be published later. On December 17 the party returned to Owatonna, Minnesota, where the work is now in progress.

Particular attention is being paid to the matter of heat losses in the barns that are being tested and we hope by the close of this winter that we will be able to secure much useful data bearing directly on this phase of our research problems.

We desire to make special mention of the work of Francis G. Benedict, director of the Carnegie Institution of Washington, Nutrition Laboratory, Boston, Massachusetts, on the determination of the carbon dioxide content of air samples. His work included some actual determinations in a barn at Durham, New Hampshire. As a result of his experience he recommends the use of the Haldane apparatus for CO_2 determinations in our research work. A report of these investigations, entitled "Carbon Dioxide Content of Barn Air," is published by the U. S. Department of Agriculture in the "Journal of Agricultural Research" Vol. 20, No. 6, December 1920.

Respectfully submitted,
Committee on Farm Building Ventilation

W. B. Clarkson, Chairman — R. U. Blasingame
Ralph L. Patty — Wm. Aitkenhead



AGRICULTURAL ENGINEERING

The Journal of the American Society of Agricultural Engineers

Contributions of interest and value to the agricultural engineering profession are solicited from members of the Society and others. Communications should be addressed to the Editor, Sta. A, Ames, Iowa.

The Journal's Service

IT IS recognized by those familiar with the situation that there is a great dearth of substantial literature on certain agricultural-engineering subjects. Little data resulting from research and experimentation conducted by commercial organizations manufacturing agricultural equipment has been made public because of the advantage it would give to competitors. The American Society of Agricultural Engineers is entitled to the credit of collecting in the Transactions of the Society the largest fund of agricultural-engineering literature to be found anywhere in the world. With the publication of AGRICULTURAL ENGINEERING, the monthly journal of the Society, a new agent has been added to the facilities of the Society for greater service in this direction.

AGRICULTURAL ENGINEERING should not in any way become a competitor with trade or technical journals published for the general reader. In fact, by publishing technical or scientific papers of direct interest to the profession it ought to prove a material aid to journals seeking general circulation. The technical material sought by AGRICULTURAL ENGINEERING should prove a great storehouse of material to be presented in a more popular form in other publications.

Again it is intended that AGRICULTURAL ENGINEERING shall prove the best agent yet provided for keeping members of the Society in touch with the work of the organization. Officers and committees will be able to present to the membership through this medium a resume of their work with the greatest efficiency. This type of service should be specific and personal as well as general. Any matter of interest to the profession can well deserve a place in AGRICULTURAL ENGINEERING.

—J. B. DAVIDSON.

The New Constitution

AT ONE of the business sessions of the Society held during the fourteenth annual meeting in Chicago, December 28 to 30, 1920, the recommendations of the Constitution Committee appointed by the Council to revise the present constitution and by-laws of the Society was approved, and since then the Council has approved the revised draft drawn up by the Constitution Committee and ordered it submitted to the voting membership of the Society for letter ballot.

Members are urged to give this matter prompt attention as soon as they receive copies of the new constitution and to send in their votes to the Secretary as soon as they have had an opportunity to go over the revised draft.

The Society is experiencing the situation of having outgrown its constitution and during the past three years the officers particularly have been impressed with the fact that the present instrument is inadequate, that it has seriously hampered the functioning of the Society. The work of standardization has been especially handicapped, and other activities have suffered as well.

The new draft of the constitution, by-laws and rules has been given very careful thought by the Constitution Committee and the Council, and with the exception of occasional changes which will be necessary with the growth of the Society and change of requirements, it is believed that this new draft provides the foundation which will be entirely adequate to provide for the future growth and development of the organization.

During the past few years particularly the Society has experienced a substantial growth and interest in its activities has increased tremendously. The future is very bright and with the more adequate provision for promoting its various activities which the new constitution, by-laws, and rules will give, the Society has a "fair field and no favor."

Contributions for the Journal

THE attention of members of the Society and others is called to the three lines in small type in the masthead on the opposite page.

One of the fundamental reasons for the establishment of AGRICULTURAL ENGINEERING is to provide a medium for the dissemination of agricultural-engineering information and to keep agricultural engineers and others in touch with the progress and development in this field.

In addition to the publication of papers, discussions, and reports, it is planned to give considerable space to the publication of original articles which will appeal particularly to engineers. AGRICULTURAL ENGINEERING is strictly an engineering publication and is not interested in contributions of essentially a trade or popular character. While a large percentage of its contents will be of such a character as to be readily understood by non-technical readers, the purpose and aim is to make it of service to the engineer primarily.

In the agricultural-engineering field there is an abundance of valuable engineering information and data which has never been circulated, and the appeal of the editorial staff to engineers in this field is "Why hide your light under a bushel?" Get it out where it will serve the public and light the way to better things. "He best serves himself by serving the public better," and one of the best ways in which an engineer can serve the public in addition to his own personal services is to put some of the things he has accomplished on paper so that it may be circulated for the benefit of other engineers, industries, and humanity in general. The editorial staff welcomes contributions from members as well as non-members of the Society, but must of course use its own discretion in the acceptance or rejection of any material for publication.

Personal News Items

MEMBERS of the Society are urged to send in for publication items regarding changes in business connections, promotions, and other activities in which they are engaged. If you are doing work which is of particular interest to other members of the Society, that is news which is particularly desired. News items of this kind will enable members to keep their friends informed of where they are, what they are doing, and will also assist in keeping the records of the society up to date. This is one of the most interesting and important sections of AGRICULTURAL ENGINEERING and it is hoped that members of the Society will cooperate with the editorial staff by sending in promptly any news items that will be of interest to other members.

A. S. A. E. ACTIVITIES

Council Meeting at Columbus

ADVANTAGE was taken of the presence of nearly all the members of the Council at the National Tractor Show to hold a meeting of the Council on February 11, all members being present except F. A. Wirt. President White and Secretary Hanson also were present.

The proposal of D.P. Weeks that a Reclamation Section be organized was discussed, and the general plan was approved. Prof. Weeks and the Sections Committee were authorized to take the necessary steps to organize such a section, which will be open to all members of any class interested in drainage, irrigation, forestry, land clearing, and so on. All persons interested are asked to send in their names to the Secretary's office as soon as possible.

The Secretary reported the present financial condition of the Society as fairly satisfactory, and that all debts from 1920 as well as the current bills for this year had been paid. Unless the membership pay their dues promptly, the Society will have trouble in getting out AGRICULTURAL ENGINEERING and the transactions at the proper time.

The Secretary presented his budget of prospective receipts and expenditures for 1921, which was discussed and approved. This is based on a membership increase of at least two hundred for the year, which can be more than met if each member will carry out the pledge of obtaining at least one new member in 1921. If anyone has already secured his new member, he should try to make it two or three; if not, he should get busy at once. The Secretary was asked to prepare each month for the information of the Council a statement of the financial standing of the Society, and was authorized to borrow not to exceed $500 if necessary in order to meet all bills promptly. He was also authorized to attend the meeting of the Southern Section of the Society at Lexington, Kentucky, February 14, 15 and 16.

The remainder of the session was spent in discussing the report of the Committee on Revision of the Constitution. After a few changes, the committee's draft was approved by the Council and will later be submitted for letter ballot.

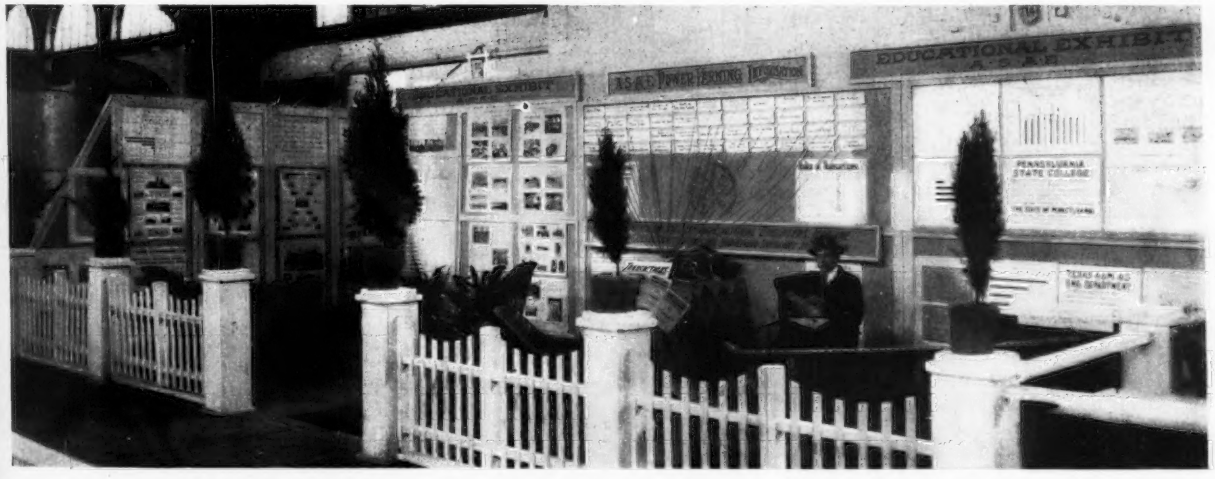
A third meeting of the Council will be called in the near future, and any questions which the members may wish to bring before the Council should be sent to the Secretary's office without delay.

Southern Section Meeting

AT THE MEETING of the Southern Section of the Society held in Lexington, Kentucky, February 14, 15, and 16, an important work was undertaken in the standardization of training in agricultural engineering in the southern colleges. Committees were appointed to work out standardized courses of study in gas engines, drainage and farm buildings. Another work undertaken through committee action is the development of a standard contract by which the loan of equipment by manufacturers to the various institutions might be facilitated. It would appear advantageous from the standpoint of both the colleges and the manufacturers that some uniform agreement might be employed, as it would simplify matters if the manufacturers loaning equipment to a number of institutions could do so through a single form of contract.

Another committee was appointed to draft a new constitution for the Southern Section. The meeting adopted a resolution calling on the Society as a whole to consider through a suitable committee the advisability of calling an international convention of the Society in Europe.

In view of the fact that Lexington was at a considerable



Unquestionably the most conspicuous educational exhibit at the tractor show at Columbus, February 7 to 12, was that of the American Society of Agricultural Engineers, the principal feature of which was the interesting and instructive charts containing data on various phases of power farming from the agricultural colleges of the states of Indiana, Iowa, Kentucky, Michigan, Mississippi, Nebraska, New York, Ohio, Texas, and Wisconsin and from the United States Department of Agriculture. Special credit is due Prof. F. W. Ives, Prof. G. W. McCuen, and the student branch members at the Ohio State University, and to Secretary Frank P. Hanson for the success of the exhibit. Mr. Hanson is shown seated in the booth

distance from the homes of most of the members the southern states were represented rather better than could be expected, the arrangement of dates so that one trip might be made to include both the tractor show and the section meeting undoubtedly making possible the attendance of many who otherwise could not have come. At the business session it was decided to hold the next annual meeting in conjunction with the Southern Agricultural Workers. The place of meeting was left to a joint committee but it is known that an invitation from the mayor of New Orleans had been received.

A feature of the first day was a motor car trip through the country adjoining Lexington visiting various farms, including particularly Cold Stream Farm. The fact that the buildings on this farm include a dairy barn and a beef barn each worth $60,000 is sufficient to show the interest it held for the engineers, particularly those interested in the housing of high-grade stock. Another point calling for special mention was a visit to one of the largest tobacco warehouses in the world where the visitors saw how the storage and treatment of tobacco prior to shipment is managed.

Officers for the ensuing year are: President, Charles E. Seitz, Virginia Polytechnic Institute, Blacksburg, Virginia; vice-president, J. B. Kelley, University of Kentucky, Lexington, Kentucky; secretary-treasurer, E. R. Gross, Mississippi Agricultural College, Mississippi.

The formal program included papers on "Standardization of Instruction of Agricultural Engineering in the South" by Daniel Scoates, Agricultural and Mechanical College, College Station, Texas; "What Should Be Included in a Four-Year Course In Agricultural Engineering" by E. R. Gross, Mississippi Agricultural and Mechanical College; "Opportunity for the Agricultural Engineers Along Commercial Lines" by F. W. Ives, department of agricultural engineering, Ohio State University and president of the Agricultural Engineering Company, Columbus, Ohio; "The Office of Rural Engineering of the United States Department of Agriculture" by S. H. McCrory, engineer in charge of Rural Engineering, Washington, D. C.; "The Tractor Situation" by W. G. Welborne, editor, The Tractor Publishing Company, Cincinnati, Ohio; "Labor Saving Machinery For Cotton Farmers" by L. E. Rast, agronomist, Southern Fertilizer Association, Atlanta, Georgia; "Paints for Farm Buildings" by W. E. Pheris, E. I. DuPoint de Nemours Company, Chicago, Illinois "Farmstead Arrangement" by J. T. Copeland, Mississippi Agricultural and Mechanical College; "Using Southern Lands Twenty-Five Per cent vs Ninety-five Per Cent" by Jesse M. Jones, general development agent, Seaboard Air Line Railway Company, Norfolk, Virginia; "Drainage Investigations in North Carolina" by H. M. Lynde, drainage engineer, Raleigh, North Carolina; "Rural Sanitation in Kentucky" by Dr. J.N. McCormack, state health officer, Louisville, Kentucky.

The morning sessions of February 15 and 16 consisted of joint meetings with the Association of Southern Agricultural Workers.

Agricultural Engineers at Columbus

ONE of the very delightful and inspiring events in connection with the Sixth Annual Tractor Show held at Columbus, Ohio, February 7 to 12, was the dinner for agricultural engineers attending the show given by the Agricultural Engineering Company, of Columbus, a firm of consulting agricultural engineers and architects, the members of which include F. W. Ives, W. B. Miller, and J. A. Howenstine, who are well known to members of the Society.

The purpose of the dinner was to provide an opportunity for agricultural engineers attending the show, particularly members of the society, to get together for social intercourse and for the discussion of matters of mutual interest. The event was a big success from the "two-cycle" cream of tomato to the "high-current" coffee and through the "exhaust" and "back fires" which followed the partaking of nourishment.

Following the dinner a very profitable two hours were spent in listening to short informal talks from those present, which had do particularly with the possibilities in the field of professional agricultural engineering.

Unquestionably one of the most important avenues of service to which the Society can give a great deal of encouragement and assistance is in promoting interest in professional agricultural engineering and putting it on a basis comparable to the position held by other professions. Already there is a much greater demand than is generally thought to exist for professional services of agricultural engineers and it is unquestionably a field in which there will be a rapid development within the next few years.

A Correction

IN THE ARTICLE, entitled "Possibilities of Alcohol for Fuel," by A. H. Gilbert, on page 5 of the January number of AGRICULTURAL ENGINEERING, reference is made to obtaining five gallons of alcohol "one hundred per cent proof" from one bushel of corn." It should read "one hundred proof," etc.

Personal News

C. M. EASON has resigned his position as vice-president of the Hyatt Roller Bearing Company to become vice-president of the Samson Tractor Company, Janesville, Wisconsin, in charge of sales and engineering.

S. H. MCCRORY, head of the division of agricultural engineering, in the bureau of public roads, United States Department of Agriculture, at Washington, was recently appointed by President White to represent the American Society of Agricultural Engineers on the American Engineering Council.

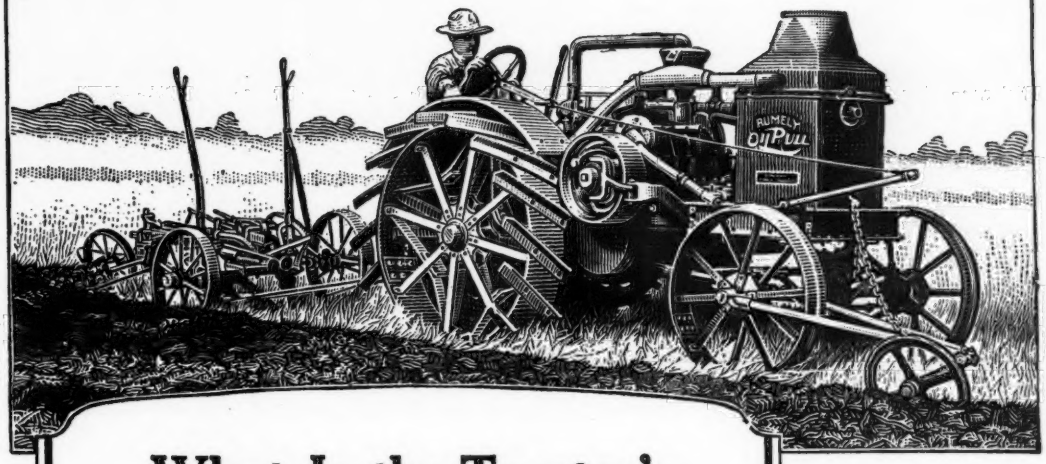
CYRUS L. COLE, who for over two years has been sales manager of the Wisconsin Motor Manufacturing Company, Milwaukee, Wisconsin, has recently become associated with Williams, Cole and Wolff, Inc., Milwaukee, Wisconsin (manufacturers district representatives) as vice-president and engineer.

A.S.M.E. Spring Meeting

THE American Society of Mechanical Engineers will hold its spring meeting May 3 to 26 at the Congress Hotel, Chicago. Sessions are planned by the professional section on aeronautics, fuels, management, material handling, machine shop, power, forest products, and railroads.

Wanted—Septic Tank Information

THE editorial staff is making an effort to procure definite information on septic tanks from authentic sources based upon scientific investigations of sizes, construction, capacity, prices, etc. This phase of farm sanitation is a very important one and one on which there seems to be a dearth of scientific information and data, at least so far as its general circulation is concerned. Members of the Society who are known to be doing work along these lines or have conducted investigations are being asked to contribute such information as is available for publication in AGRICULTURAL ENGINEERING. Undoubtedly members of the Society and others are working upon these problems and those who are doing so or know of others who are working on them are requested to write the editor and so advise him.



What Is the Tractor's Record of Economy?

Before you make your tractor contract, get its *record* of economy.

Don't be satisfied with merely statements of what the tractor will or *may* do under *certain* conditions, but get a record of what it has done under *all* conditions over as long a period of time as possible.

The story of any one of thousands of old OilPull tractors, scattered throughout the world, would prove the unequaled economy of the OilPull. Take the one owned by Radtke Bros., Spiritwood, North Dakota, which was bought nine years ago. Its owners have always given it hard service the year 'round—plowing and breaking sod, threshing, operating feed mill, etc.

For seven years it performed faultlessly without the need of a single important repair! It is now nine years old and not half "worked out." Many twelve-year-old OilPulls, including the first one built, are still on the job!

The OilPull's remarkable economy in fuel is well and widely established. For the last nine years the OilPull has held the world's tractor fuel economy record! And—consider this point—the OilPull is the *only* tractor backed by a written guarantee to burn successfully all grades of kerosene, under all conditions up to its full rated brake horsepower! The OilPull is the tractor of *proved* economy. When you sell an OilPull you *know* you are selling the tractor that is cheapest in cost per year of service.

Have us tell you about other OilPull features that are as outstanding as its economy—about its dependability, long life, etc.

And have us tell you about the great service organization back of every Advance-Rumely dealer.

ADVANCE-RUMELY THRESHER COMPANY, *Inc.*
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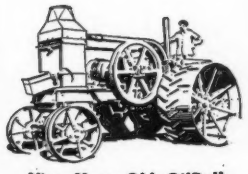

Nine-Year-Old OilPull Owned by Radtke Bros. Spiritwood, N. D.

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Guaranteed to burn kerosene under all conditions up to its full rated brake horsepower. Holds the present world tractor fuel economy record.

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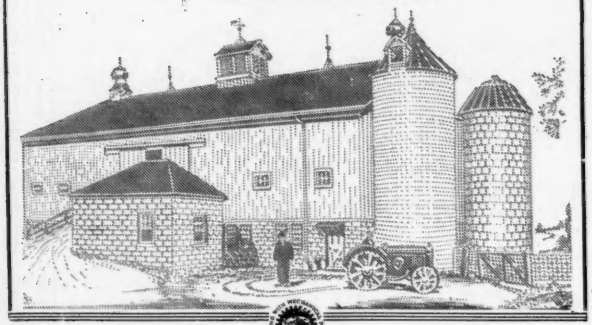
This institution originated the term "power farming" as applied to farming with mechanical power.



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A. S. A. E. Transactions

THE most complete library of agricultural-engineering information in existence is to be found in the Transactions of the American Society of Agricultural Engineers. Many new members will want to secure a set of the Transactions as long as they last. With the exception of the first three or four volumes, which are out of print, the Secretary of the Society has on hand a limited supply of the Transactions for sale to members of the Society and others. Address Frank P. Hanson, Secretary, American Society of Agricultural Engineers, Station A, Ames, Iowa.

New Members of the Society

Harold W. Ferris, sales manager and engineer, Consolidated Gas Engine Company, New York City.

Joseph Cumming Elliff, salesman and demonstrator, Hercules Powder Company, Little Rock, Arkansas.

Fred L. Warner, chain sales engineer, Link-Belt Company, Indianapolis, Indiana.

Lamer C. LeBron, assistant professor of agricultural engineering, Alabama Polytechnic Institute, Auburn, Alabama.

Harry B. Cole, formerly assistant experimental engineer, Moline Plow Company, Moline, Illinois.

J. H. Needler, sales engineer, Link-Belt Company, Chicago, Illinois.

Raymond Bert Wheeler, sales department, Roderick Lean Manufacturing Company, Mansfield, Ohio.

Harley M. Ward, engineer, Hollow Tile Building Association, Chicago, Illinois.

Walter G. Ward, extension architect, Kansas State Agricultural College, Manhattan, Kansas.

C. Frederick Cunningham, secretary and manager, Oliver Chilled Plow Works, South Bend, Indiana.

Applicants for Membership

The following is a list of applicants for membership received since the publication of the January issue of AGRICULTURAL ENGINEERING. Members of the Society are urged to send pertinent information relative to the applicants for consideration of the Council prior to their election.

Edward W. Ahrendt, superintendent of experiments, International Harvester Company, Neuss o. Rhine, Germany.

David E. Ball, assistent hydrographer, U. S. Reclamation Service, Yakima, Washington.

Henry N. Edens, chief engineer and works manager, John Lauson Manufacturing Company, New Holstein, Wisconsin.

Conrad Erwin Frudden, engineering manager, Hart-Parr Company, Charles City, Iowa.

Arthur T. Logan, salesman, King Ventilating Company, Owatonna, Minnesota.

Carl Josef Sonander, superintendent of experiments, International Harvester Company, Norrkoping, Sweden.

J. Alden Werden, farmer, McHenry, Illinois.

Ernest C. Downing, farmer, Sioux Rapids, Iowa.

Lee H. Kaupke, chief designer, Rock Island Plow Company, Rock Island, Illinois.

Carl David Gross, student, Kansas State Agricultural College, Manhattan, Kansas.

Gerald C. Sharp, student, Kansas State Agricultural College, Manhattan, Kansas.

W. H. Craig, student, Ohio State University, Columbus, Ohio.

W. A. Cromley, student, Ohio State University, Columbus, Ohio.

R. O. Keyser, student, Ohio State University, Columbus, Ohio.

F. G. McCollester, student, Ohio State University, Columbus, Ohio.

T. R. Newell, student, Ohio State University, Columbus, Ohio.